Section 2550.7. General Water Quality Monitoring and System Requirements.

Specific Purpose

The specific purpose of this section is to assure that monitoring systems used in monitoring and response programs provide water quality data and statistical determinations which satisfy the performance standards of those monitoring and response programs.

Factual Basis

There are three media which either consist of or contain water that can be affected by a release from a classified waste management unit: the ground water medium; the surface water medium; and the unsaturated zone medium. The performance goal of water quality monitoring systems is to determine the condition of those portions of the monitored medium that either could be affected by a release or have been so affected. This monitoring effort breaks down into three primary approaches: (1) to detect a release from a waste management unit; (2) to evaluate the nature and extent of a release that is known to exist; or (3) to validate the success of applied corrective actions in bringing the unit back into compliance with the Water Quality Protection Standard. In order to achieve this performance goal, the monitoring systems must be placed, designed, constructed, and operated in a manner which produces water samples that are as representative as possible of the in-situ water in the medium being sampled. There are certain minimum standards of placement, design, construction, and operation which have been found to be necessary in achieving this design goal. These standards differ considerably between the various media. In technical work such as the design and installation of monitoring systems, it is important that the person carrying out the work have training and professional experience in such work in order to provide some assurance that monitoring systems will meet the performance standards and other requirements of the regulations. This section is necessary in order to clarify the requirements that any monitoring system or statistical method proposed by the discharger must achieve, at a minimum.

This section is based on 40 CFR 264.95. Certain structural changes from the text of 40 CFR 264.97 were made for the sake of clarity, for incorporating the more-stringent requirements of repealed Article 5, and for including surface water and

unsaturated zone monitoring requirements in this section. This section conforms to the corresponding federal regulation except for the generic changes specified in the introduction to this Statement of Reasons and in the article overview and as follows.

Comments on Section 2550.7:

Comment: This section lacks sufficient clarity, criteria, and guidance for operators and regional boards alike. The use of terms such as "appropriate", "adequate", and "sufficient" without specific goals or criteria may lead to rulings by regional boards that will vary from region to region.**[42J,44E]** Rather than set a minimum number of monitoring wells, the revised revisions merely state that a "sufficient number" of monitoring points be established, thus effectively forcing dischargers and regional boards to argue over this issue in every case, even in those cases in which leaks have already occurred.**[46B]** The regulations give dischargers wide latitude in proposing methods to determine when releases are "significant" enough to warrant corrective action. Case-by-case interpretation of a wide variety of site-specific proposals, with minimal regulatory guidance, will impede implementation of monitoring and response programs and will continue to make enforcement actions difficult.**[46C]** The State Board should specify the minimum number of monitoring wells necessary for ground water, surface water, and unsaturated zone monitoring under Subsections 2550.7(b), (c), and (d).**[46K]**

Response: The regulations were not changed in response to these comments for the following reason. The words "appropriate", "adequate", "representative", and "sufficient", taken alone, would indeed provide an inadequate degree of guidance in their implementation; however, these words are used in this section only with accompanying performance standards with which their application can be modulated to the specific circumstances under which they are being applied [See Subsections 2550.7(b)(1)(A), (b)(1)(B)1., (b)(1)(B)2., (b)(1)(B)3., (b)(1)(C)1., (b)(1)(C)2., (b)(1)(D)1., (b)(1)(D)2., (b)(2), (b)(5), (b)(6), (b)(7), (c)(2)(A), (c)(2)(B), (c)(2)(C), (c)(2)(D), (d)(2)(A), (d)(2)(B), (d)(2)(C), (d)(2)(D), (e)(2)(B), (e)(5), (e)(6), (e)(8)(E)2., (e)(9)(A), (e)(12)(A), (e)(12)(B), and (e)(14) of the revised article]. This approach avoids the inappropriate results that typically result from the application of minimum prescriptive standards. Therefore, these regulations will provide similar applications in similar situations.

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Subsection 2550.7(b)

Specific Purpose

The specific purpose of Subsection (b) is to specify the performance standards which will be used to evaluate the acceptability of background and downgradient ground water sampling systems.

Factual Basis

The three media monitored under this article [ground water, surface water, and the unsaturated zone] differ greatly from each other with regard to the manner in which they must be manipulated to produce a representative sample. Therefore, each monitored medium requires its own monitoring system requirements. For purposes of clarity, this subsection incorporates all the general monitoring requirements that apply exclusively to the ground water medium. The Subpart F regulations [under 40 CFR Parts 264 and 265] included no such medium-specific system demarcation because they primarily address the ground water medium.

It has been the experience of State Board staff, in reviewing design and operation proposals for ground water monitoring systems, that elements basic to any ground water program are frequently not considered in the design. These elements are critical to the accurate interpretation of ground water quality. The provisions of Subsection (b) are intended to assure that the basic elements of ground water monitoring system are considered in the design of ground water monitoring systems for waste disposal facilities and to insure that the work is performed by people who are trained for such work. A ground water monitoring system that is not designed, constructed, and operated according to the provisions of this subsection will have a high probability of failing to protect human health and the environment.

These subsections are necessary to provide a clear and consistent delineation of the basic elements of an effective monitoring system for the ground water medium.

Comment on Subsection 2550.7(b):

Comment: To assure consistency with new requirements in the Water Code for the regulation of monitoring wells, this subsection should be amended to include the following requirement: "Monitoring wells shall only be constructed or destroyed pursuant to and in conformance with a written permit issued by the city or county agency responsible for enforcement of the well ordinance required under Sections 13701-13805 of the California Water Code. Standards for construction or destruction of monitoring wells shall be consistent with Bulletin No. 74-90 (supplement to Bulletin No. 74-81) of the Department of Water Resources and future amendments thereto."**[53A]**

Response: The regulations were not changed in response to this comment for the following reasons. Nowhere in the California Water Code is the regional board authorized to prescribe well standards in waste discharge requirements. The Water Code empowers the counties to enforce well standards; therefore, for the regional board to reiterate these requirements would constitute needless duplication. Regulations cannot incorporate by reference prospective changes to the regulations of the Department of Water Resources or, for that matter, the regulations of any other agency.

Comment: The revised article requires all Chapter 15 facilities to conduct ground water monitoring whether or not there is ground water located at the site or ground water is at a substantial depth [e.g., >1,000 feet]. No exemption to this requirements is provided. For those sites where ground water is nonexistent or is at such a depth that monitoring is infeasible, impractical, or not indicative of leakage, an exemption from the ground water monitoring requirements should be available. We suggest that an exemption similar to that provided for the unsaturated zone monitoring requirement [Subsection 2550.7(d)(5)] be provided for the ground water monitoring requirement. Without an exemption in the regulations, regional board staff would be left with two unenviable options:

1. Ignore the Chapter 15 regulations; or

2. Implement the regulations and violate the California Water Code [Section 13267(b)] by requiring monitoring which does not justify a cost that bears a reasonable relationship to the benefits of the data.**[49A]**

Response: The regulations were not changed in response to this comment for the following reasons. The authority granted the State Board under the Porter-Cologne Water Quality Control Act [Porter-Cologne] charges the State Board with writing regulations which protect the existing and potential future beneficial uses of waters of the State, including any beneficial uses of deep aquifers or of perched ground water that is of limited extent. The "beneficial uses" of a body of ground water are to some degree contextual, being influenced by the ground water body's depth, extent, and chemical make-up; the present and potential future demographics of the area; the rainfall intensity and distribution in the area; and other relevant factors. In this context, if the regional board decides that a waste management unit has no potential to adversely impact ground water or surface water, there is no basis for the regional board to implement Article 5. Under such circumstances the question of how to apply the article becomes moot. On the other hand, if **any** beneficial use could be put at risk in the event of a release from the unit, there is no alternative to requiring a comprehensive monitoring program for each medium that could be affected by a release [ground water, surface water, and the unsaturated zone].

Comment: Separate background monitoring wells should sample each potentially affectable aquifer and background monitoring should begin in all monitoring wells prior to the facility receiving waste to establish historical background water quality for all new facilities. **[42K]**

Response: The regulations were not changed in response to this comment because Subsections (b)(1)(B)3., (b)(1)(C)2., and (b)(1)(D)2. of this section already require all affectable portions of the zone of saturation to be monitored separately from the uppermost aquifer, and because Subsection (e)(6) of this section already requires new units to collect background data for at least a full year prior to discharge.

Comment: Subsections (b)(1)(C)1. and (b)(1)(D)1. should be rewritten so that it is clear that the monitoring is required at the point of compliance. **[27A135]**

Response: In response to this comment, the phrase "that represent the quality of ground water passing the point of compliance" has been included in these subsections.

Comment: Aquifers below the uppermost aquifer could become contaminated as a result of discharge from the waste management unit. It would be wise to monitor the background in these aquifers as well. **[410]**

Response: The regulations were not changed in response to this comment because this subsection provides ample direction to the regional board to require the discharger to monitor portions of the zone of saturation other than the uppermost aquifer in cases where a release might affect other than the uppermost aquifer [see Subsections (b)(1)(B)3., (b)(1)(C)2., and (b)(1)(D)2. of this section]

Subsection 2550.7(b)(1)

The waste in each waste management unit, the design of each unit, and the hydrogeology underlying each unit typically differ sufficiently that each unit must have a ground water monitoring system designed for it alone. Only in this way can there be assurance that a release from any one unit will be discovered, evaluated, and corrected in the shortest possible span of time. The requirement for each unit to have its own ground water monitoring system is retained from repealed Article 5 [Subsection 2556(a)(2)] but the majority of the other requirements derive from 40 CFR 264.97 [also see: 47 Federal Register <32305>/ 11 b. Detection monitoring system].

Comments on Subsection 2550.7(b)(1):

Comment: Subsections (b)(1)(B)3. and 4., (b)(1)(C)3. and 4., and (b)(1)(D)2. and 3. establish the requirements for the ground water monitoring systems for detection, evaluation and corrective action monitoring programs in ground water other than the uppermost aquifer. The need to install a monitoring system within the zone of saturation and in perched zones should be dependent upon site-specific hydrogeologic conditions and potential negative impact to the ground water quality. Specifically, monitoring wells should not be installed at depths below the uppermost aquifer until such time as a release has been verified in the uppermost aquifer because such wells can act as conduits for surface contamination to migrate downward. Reference to the zone of saturation in these subsection should be restricted to exclude zones of saturation beneath the uppermost aquifer. Monitoring of such zones is redundant and counter-

productive since by definition ground water does not flow preferentially through such a unit, and drawdown created during well evacuation could draw overlying ground water downward. **[56P]**

Response: The regulations were not changed in response to this comment for the following reasons. The referenced subsections all contain performance standards which limit their universal application. When ground water other than the uppermost aquifer can be impacted by a release from the unit, then it is appropriate to monitor that ground water. If potentially-affectable ground water cannot and should not be monitored, as the commentor suggests, then there is no way to protect such waters of the State from being affected by the unit; under such circumstances, it is not appropriate to permit the unit to operate.

Comment: The revised regulations seem to provide broad regulatory avenues to allow the regional boards to prescribe monitoring points and sampling frequencies at virtually any point in the subsurface strata that could be affected by a waste management unit. In many instances this seems to be without regard for reliance on monitoring those potential pathways that provide for the greatest likelihood of detection. One example of this is seen in new language to Subsections 2550.7(b)(1)(B)3., (C)2., and (D)2. which allow for the monitoring of aquifers other than the uppermost aquifer if the likelihood of detecting a release is virtually anything greater than zero. Indeed, the establishment of monitoring systems which penetrate the uppermost aquifer to reach other aquifers could provide for a pathway of contamination from the uppermost aquifer and should not be encouraged. **[56I]**

Response: The regulations were not changed in response to this comment for the following reasons. The referenced subsections all are limited a performance standard: the performance standard of Subsection (b)(1)(B)3. is "...to provide the best assurance of the earliest possible detection of a release...."; the performance standard of Subsection (b)(1)(C)2. is "...to provide the data needed to evaluate changes in water quality due to the release...."; and the performance standard of Subsection (b)(1)(D)2. is "...to provide the data needed to evaluate the effectiveness of the corrective action program." Extraneous monitoring points which do not pass these performance standards cannot be required under these subsections.

Comment: The requirement in Subsections (b)(1)(B)3., (b)(1)(C)2., and (b)(1)(D)2. to monitor additional aquifers and zones of perched water should be removed because the phrase "additional aquifers and zones of perched water" is vague and because these bodies of water may not be affected by a release from the unit and because perched water which comes and goes according to rainfall does not allow for a statistical basis for comparison. **[18T,25T]**

Response: The regulations were not changed in response to this comment for the following reasons. The requirement to monitor additional aquifers and perched zones is included in order to address any perched zones or aquifers other than the uppermost aquifer that are identified as being likely to be affected by a release from the unit. Such water bodies will be identified either in the hydrogeologic assessment required as part of the initial Report of Waste Discharge, pursuant to Section 2595 of this chapter, or as a result of additional investigations required by the Regional Board. The requirements under Subsection (b)(1) are needed in order to clarify how such water bodies shall be monitored, once they are identified as being affectable by a release. It is reasonable to require such water bodies to be monitored prior to a release because it can happen that a release is detected in one of these bodies that was not identified in the unsaturated zone or in the uppermost aquifer. Lastly, perched zones which are present only after a rainfall may require special statistical methodology such as the use of intra-well comparisons, but such comparisons are not beyond the capability of a competent statistician.

Subsection 2550.7(b)(1)(A)

Representative background data is essential as a basis for comparison with samples from [downgradient] monitoring wells because only background data that is representative of in-situ ground water that is unaffected by a release can provide a reliable reference against which monitoring well data can be statistically compared. This subsection clarifies the requirements under Subsection 2555(b) of repealed Article 5; therefore, it does not constitute a new regulation.

Subsection 2550.7(b)(1)(B)

The goal of monitoring under the Detection Monitoring Program is to determine the presence of a release from the unit at the earliest possible moment in order to help limit the size of the

plume resulting from the release. Other monitoring and response programs have different goals and, therefore, different requirements for the ground water monitoring system. The specific differentiation of intent between monitoring programs in the revised regulations is done for the purpose of providing clarity.

The performance standards under this subsection include criteria for evaluating the locations of monitoring wells, the well depths, and the screened intervals so that there will be a screened interval athwart each anticipated pathway of pollutant migration. Such performance standards are necessary because the movement of contaminants in the ground water often has a downward competent which can carry the plume under wells that are situated near the water table. In addition, the local flow direction in the horizontal plane may differ considerably from that indicated by a more regional perspective. In such cases, wells screened at a shallow depth in the uppermost aquifer can fail to detect the presence of a release. However, shallow wells are essential under conditions where a low-density liquid is released because such a release will migrate at or near the ground water surface. To be effective in protecting water quality, the ground water monitoring system for each unit must be specifically designed for the hydrogeologic conditions beneath the unit and for the wastes that the unit is to contain. There must be enough well/depth combinations to intercept the specific pathway that each contaminant is likely to take during a release from any portion of the waste management unit.

In the Preamble to 40 CFR 264.95, USEPA states that their study of plumes emanating from hazardous waste facilities indicates that wells along the point of compliance provide a reliable detection strategy because the point of compliance represents the closest practical location to release This provides the earliest possible warning of ground water contamination from the unit and results in a lower volume of contamination to clean up than would be the case with detection at a greater distance from the unit [47 Federal Register 32299/Monday, July 26, 1982/6. Compliance point]. This is a reasonable first-line monitoring approach for all waste management units; therefore, the performance standard under revised Subsection (b)(1)(B)1. incorporates the federal approach to ground water monitoring.

Hydrogeologic conditions, such as [discontinuous] clay lenses beneath the unit, can enable a release to be transported laterally prior to reaching the uppermost aquifer such that wells at the point of compliance are unlikely to detect the release.

In such cases, proper ground water protection can only be achieved through placing wells at locations in the uppermost aquifer that are at or downgradient of the location(s) where the contamination will enter the aquifer. Subsection 2510(a) of Chapter 15 provides that the Regional Boards may impose more stringent requirements to accommodate regional- and site-specific conditions. Revised Subsection (b)(1)(B)2. clarifies existing Subsection 2510(a) as it applies to monitoring of the uppermost aquifer under the conditions described above.

In cases where zones of perched water exist between the base of the unit and the uppermost aquifer or in cases where aquifers other than the uppermost aquifer could potentially be affected by a release from the unit [without first being detected by monitoring wells in the uppermost aquifer], these perched zones and susceptible aquifers must be monitored in order satisfy the performance standard of providing the earliest possible detection of a release. Subsection 2510(a) of Chapter 15 provides that the Regional Boards may impose more stringent requirements to accommodate regional and site-specific conditions. Revised Subsection (b)(1)(B)3. clarifies Subsection 2510(a) as it applies to the monitoring of perched ground water and susceptible aquifers other than the uppermost aquifer underlying the unit.

Comment on Subsection 2550.7(b)(1)(B):

Comment: Subsection (b)(1)(B)5. requires that monitoring point locations and depths include zone(s) of highest hydraulic conductivity in each ground water body. Such zones may not be appropriate for the fastest detection of all chemical constituents. This section should be changed to read "...locations and depths necessary for the earliest possible detection of waste constituents."**[59F,66B]** The requirement in Subsection (b)(1)(B)5. is redundant to those in Subsections 1. through 5. and should, therefore, be eliminated.**[61B,63A]**

Response: The regulations were not changed in response to these comments for the following reasons. Subsection (b)(1)(B)2. requires monitoring points to be situated to provide the earliest detection of a release whereas Subsection (b)(1)(B)5. is **additional** to that requirement; therefore, there is no redundancy. Subsection 5. is intended to help make up for the fact that perfect knowledge of the subsurface is impossible, such that monitoring points placed with the intention of providing the earliest detection often will not intercept the release. Given that superb knowledge of the subsurface is typically unavailable,

it is wise to also monitor the fastest-moving portions of an aquifer because a release which is missed by the other monitoring points is very likely to show up there and be picked up.

Comment: Subsection (b)(1)(B)2. appears to be redundant because Subsection (b)(1)(B)1. will provide the earliest possible detection of a release from a waste management unit. Monitoring wells are installed adjacent to waste management units to provide the earliest possible detection of a release. It is not clear what additional information Subsection (b)(1)(B)2. would provide that is not already provided by the requirements of Subsection (b)(1)(B)1. **[48H]**

Response: The regulations were not changed in response to this comment for the following reasons. Wells along the point of compliance will not always provide the earliest detection and measurement of a release. For example, there are many hydrogeologic settings in which considerable lateral migration of a release can occur within the unsaturated zone before reaching the ground water [e.g., discontinuous clay lenses in the unsaturated zone]. Under such conditions, there is a good chance that the release will not show up at the wells along the compliance point. This is because the release will have either passed over them in the unsaturated zone or moved laterally in the unsaturated zone [relative to the ground water flow direction] prior to entering the ground water, thereby causing the release to pass to the side of the compliance point wells. The latitude for the regional board to specify ground water monitoring points additional to those required along the point of compliance is reflected in many locations within the revised article and is necessary to provide the earliest possible detection of a release [see Subsection 2550.5(a) and Subsections 2550.7(b)(1)(B)3., (b)(1)(B)4., (b)(1)(C)2., (b)(1)(C)3., (b)(1)(D)2., and (b)(1)(D)3.].

Comment: Subsection (b)(1)(B)3. should be expanded to include all aquifers capable of being affected by the waste management unit. **[42L]**

Response: The regulations were not changed in response to this comment because the referenced subsection already achieves the goal suggested. This subsection, as revised, and Subsection (b)(1)(B)4. require the discharger to monitor all affectable ground water that is not included under the monitoring provisions addressing the uppermost aquifer.

Comment: Detection monitoring should not be required, as it is under Subsection (b)(1)(B)3., in aquifers other than the uppermost aquifer unless contamination of the uppermost aquifer has been found. **[29C]**

Response: The regulations were not changed in response to this comment for the following reasons. The purpose of detection monitoring is to detect a release from the unit. All water bodies that could be affected by a release should be monitored because it is possible, for example, for a release to bypass the monitoring points in the uppermost aquifer and be detected first at monitoring points in another part of the zone of saturation or in a zone of perched ground water. In any case, once a release has been detected, the affected monitoring points will be included in the evaluation monitoring program. If an affectable aquifer (other than the uppermost aquifer) lacked monitoring points, then it would not be possible to determine if the release had migrated into that aquifer as well, so the entire aquifer would have to be included in the evaluation monitoring effort and could not at that time begin detection monitoring as suggested by the commentor.

Comment: The regulations should be changed so that the point of compliance can be located further downgradient from the unit, so as to include the additional monitoring points described under Subsection 2550.7(b)(1)(B)2. This would be more in line with the approach used under Section 2553 of repealed Article 5. **[36U]**

Response: The regulations were not changed in response to this comment because the federal compliance point usage must be retained in order to provide consistency with the federal regulations. At the same time, the need for additional monitoring points (i.e., not at the compliance point) envisioned under Section 2553 of repealed Article 5 is still valid. Therefore, the revised regulations include mandatory monitoring points at the point of compliance as well as providing for the establishment of additional monitoring points at other locations, as deemed effective and necessary by the Regional Board for providing the earliest possible indication of a release.

Comment: For consistency with other provisions under Subsection (b)(1)(B), the term "additional aquifers" in

Subsection (b)(1)(B)3. should be changed to "other aquifers". **[27A57c]**

Response: The regulations have been changed in accordance with this comment.

Subsection 2550.7(b)(1)(C)
In addition to the functions carried out under the Detection Monitoring Program, the ground water monitoring system under an Evaluation Monitoring Program must be able to show the nature and extent of the release and to indicate any changes in the plume that may occur prior to the initiation of a Corrective Action Program. This is not a new requirement, but is rather a clarification of the performance standards required of a ground water monitoring system use to delineate a release in the existing federal regulations [termed "compliance monitoring"] and in the State Board's regulations [termed "verification monitoring"]. [See repealed Section 2557 of Chapter 15 and 40 CFR 264.99.]

Releases from waste management units constitute threats to human health and the environment. The specific course of action that will best address the cleanup of the release cannot be determined until the nature and extent of the release is fully known. Detection monitoring is only intended to detect a release, not to provide information upon which a corrective action decision can be based. Therefore, the performance standards under this subsection apply during an Evaluation Monitoring Program to all wells included in that program, including appropriate downgradient wells in affected portions of the uppermost aquifer and all wells and background wells in affected portions of other monitored aquifers and zones of perched water. The specific number of such wells required will vary depending upon site-specific, waste-specific, and release-specific conditions. These performance standards are satisfied when there are enough wells both to indicate the three-dimensional spatial distribution and concentration gradient of each constituent within the plume and to reflect any changes in the plume through time. Delineation of the nature and extent of the release is a necessary prerequisite to the design of corrective action measures that will effectively address the release.

Subsection 2550.7(b)(1)(D)
The performance standard of a ground water monitoring system under a Corrective Action Program is that it must be capable of

verifying that the corrective action measures taken are proving effective in reducing all Constituents of Concern within the plume to below their respective concentration limits within the time anticipated, and that the plume is not being permitted to enlarge. If the corrective action measures are failing in either of these areas, then the measures will have to be augmented. This performance standard is necessary because monitoring is the principle means by which the effectiveness of the corrective action measures is evaluated.

The specific number of such wells required in the ground water monitoring systems for the uppermost aquifer, for perched zones, and for other monitored aquifers affected by the release will vary depending upon site-specific, waste-specific, and release-specific conditions, but must be enough to validate the effectiveness of the corrective action measures taken to control the plume's movement and to reduce the concentrations of the constituents making up the plume. This subsection is necessary to clarify the goal of the ground water monitoring system for a Corrective Action Program. This is not a new requirement, but is rather a clarification of the performance standards required of a ground water monitoring system under a Corrective Action Program in the existing federal and State regulations [see 40 CFR 264.100(d) and Subsection 2558(a)(3) of repealed Article 5, respectively].

Subsection 2550.7(b)(2)

There are some conditions under which it is simply not possible to establish a background monitoring point for ground water in the normal manner. On page 32302 of the July 26, 1982 final rule [47 Federal Register], and on page 39722 of the October 11, 1988 final rule [53 Federal Register] USEPA discusses the use of intra-well comparison techniques in which a monitoring well's historical background data is used as a background database against which current ground water quality at that well can be compared [40 CFR 264.97(a)(1)(i)]. This subsection is needed in order to enable the use of intra-well comparison techniques, where the discharger can show that these will be effective in delineating background for use with the control chart statistical method. This subsection may also be invoked where immovable physical obstacles prevent the installation of wells directly upgradient of the unit, so long as the discharger can show that the alternative background monitoring point will reliably represent the quality of ground water under the unit that has not been affected by a release from that unit.

Revised Subsection (b)(2) is derived from the federal language and permits the use of an alternative background scheme only in cases where the discharger can demonstrate that background ground water quality is accurately represented. This provision is retained from the federal regulations for purposes of equivalency with those regulations, as mandated under WC 13172(d).

This subsection addresses "alternative background monitoring points". It is carefully written to avoid any implication that the discharger can propose an alternative to background monitoring itself. The background data provides the only viable reference point against which downgradient water quality data can be compared. There are sites at which good background data cannot be obtained, due to complicated hydrogeology, geochemistry, or other factors. Without reliable background data, it is impossible to tell if a release has occurred. If it is not possible to determine what "background" is, then the only responsible action is to deny the site the privilege of operating.

Comments on Subsection 2550.7(b)(2):

Comment: With respect to the determination of background water quality, the regulations are only appropriate for landfills that are located over very specific hydrogeologic conditions. There are many existing and proposed landfill sites where these conditions do not exist. The Sanitation Districts do not believe the State Board wishes to restrict landfills only to those areas where easily-defined aquifers underlie the landfill sites, allowing for direct comparisons of background and downgradient water quality conditions. The State Board should, therefore, allow for flexibility in the design of leak detection methods for those sites that overlie complex hydrogeologic conditions. **The Sanitation Districts agree with the State Board in their view that sites where leaks cannot be detected should not be allowed to operate.** However, the Sanitation Districts believe that the State Board should allow the regional boards to have latitude in approving alternative methods of background water quality determination that are based on site-specific conditions at those sites where background water quality cannot be determined through conventional means. Therefore, the Sanitation Districts propose the following additional language to be added to Subsection 2550.7(b)(2) of the revised regulations:

> ".... The regional board may also allow for alternative procedures, based on site-specific conditions, for the

determination of background water quality at those sites where conventional methods as outlined in these regulations cannot be used."**[55B]**

Response: The regulations were not changed in response to this comment for the following reasons. Neither the comment nor the proposed additional regulatory language is explicit regarding the "alternative" background-determination method; therefore, it is not possible for State Board staff to analyze the effectiveness of the proposal. State Board staff considers the use of upgradient monitoring wells to be an essential cornerstone of reliable leak detection. Even in cases where the use of intra-well comparisons are appropriate, it is still necessary to reference upgradient background concentrations in order to validate the use of the method initially and to pick up changes in background water quality which would invalidate the continued use of the method. If a discharger is comparing downgradient ground water quality with that of "background" wells which are not upgradient [i.e., with ground water that is not along approximately the same flow line as the water passing the downgradient wellscreen], then the comparison cannot be relied upon to detect a release because the comparison will be between waters whose differences may not reflect the influence of the waste management unit. Therefore, State Board staff believes that at sites where intra-well comparisons cannot be used and where upgradient background ground water quality cannot be determined, reliable detection cannot be implemented. It is not appropriate to site or operate landfills in areas where a ground water monitoring system cannot reliably detect a release.

Comment: This subsection specifically recognizes that there may not be an "upgradient" location for establishing background values, as is the case in fractured rock environments.**[12H,16E]** Subsection (b)(2) for alternate locations for background wells does not adequately deal with canyon landfills that have no upgradient water and may contain contaminants from other sources.**[42M]**

Response: The regulations were not changed in response to these comments because the commentors' interpretation of the wording of this subsection is incorrect. In most cases it is possible to ascertain the upgradient direction, that is to say, the direction from which ground water is approaching the site. Wells located in this upgradient direction typically provide the most representative indication of the quality of ground water that would have been observed in the area of the unit prior to its

having received waste. Such "background" water quality is normally the best basis of comparison for use in ascertaining whether or not water beneath the unit has been contaminated by a release from the unit. In cases where it is not physically possible to establish enough background monitoring points in the directly upgradient direction, then alternative locations can be used if these can be shown to be representative of background water conditions. There are also a limited number of hydrogeologic conditions where this subsection could be applied, such as when a unit is situated to cover the entire top of a hillside. Under most conditions, however, the installation of upgradient monitoring points is required. In cases where there truly is no way to know which way the ground water is flowing, then monitoring for a release cannot provide a reliable indication that a release has occurred. In such cases there is no valid basis for permitting the unit to begin [or continue] operations because it is impossible to provide reliable protection to human health and the environment under such circumstances.

Comment: One commentor stated that in addition to having the potential to allow the use of alternative wells to determine background water quality [as under Subsection 2550.7(b)(2)], that the regulations should also allow the use of alternative procedures in making this determination [e.g., soil equilibrium studies]. **[2D,26C]**

Response: The regulations were not changed in response to this comment for the following reasons. Reliable background data are an essential prerequisite to detecting the presence of a release. The method proposed by the commentor (i.e., soil equilibrium studies) has not been used previously as a substitute for reliable background ground water monitoring. Until its use can be validated as providing a reliable yardstick against which downgradient ground water can be tested to indicate a release, the use of this method cannot be taken as a substitute for background ground water determinations, but may serve as a useful adjunct to it. It should also be noted that in cases where background water quality data obtained either from background wells or through the use of the intra-well comparison technique will not provide a reliable yardstick against which to compare downgradient water quality, the unit should not be allowed to operate [or to continue operating] because it will not be possible for the requirements of this section to be met. Enabling an unmonitorable unit to operate is analogous to permitting a blind person to operate a motor vehicle. If the

discharger cannot reliably detect a release, then there is no alternative but to deny the discharger the right to operate the unit.

Comment: One commentor identified a typographical error in the April 25, 1989 draft of this subsection and also suggested that the phrase "at other wells" be changed to "at the other wells". [370]

Response: In response to this comment, the typographical error was corrected. However, the suggested change of phraseology was not carried out because the existing wording is sufficiently clear.

Subsection 2550.7(b)(3)

The Department of Water Resources requires all well drillers to submit a drilling log for each well installed. This log is expected to contain information that will augment or corroborate the more detailed drilling log created by the on-site registered geologist. Therefore, the regulations require that a copy of the driller's log be submitted to the regional board.

Comments on Subsection 2550.7(b)(3):

Comment: No allowance is made for Department of Water Resources [DWR] programs which have been given to counties to administer. [29D]

Response: In response to this comment, the portion of this subsection requiring submittal of the driller's log to DWR on a specific DWR form has been eliminated.

Subsections 2550.7(b)(4) through (b)(7)

The primary goal of a monitoring well is to provide samples of ground water that are as representative as possible of the in-situ characteristics of water within the aquifer. This goal can only be achieved if: (1) the well does not serve as a conduit transporting water from any one part of the well bore to any other part; and (2) sediment-free water can be extracted from the formation surrounding the sampling interval through the induction of a small pressure gradient. If a well acts as a conduit facilitating movement of water from one level of the well to another, then the samples produced by the well will likely

reflect the quality of the allochthonous water [i.e., transported water] rather than that of native water surrounding the sampling interval. Such wells produce misleading data and can also spread the contamination.

Wells which are "designed" and constructed using generic filter packs and screen slot sizes, or which are not properly developed, typically fail to produce representative samples. This is because large pressure gradients are necessary to extract samples from the surrounding formation, typically resulting in sediment-laden samples whose water chemistry is considerably altered from that of undisturbed water in the formation. Effective ground water protection relies heavily upon the integrity of all monitoring wells in the ground water monitoring system. These subsections contain minimum performance standards that are necessary to assure proper performance of each monitoring well. These standards are retained from existing federal and State regulations and do not constitute new requirements [40 CFR 264.97, and 23 CCR 2555 (in repealed Article 5)].

Comments on Subsection 2550.7 (b)(6):

Comment: The revised subsection implies that the monitoring well will be screened only below the water table and not into the unsaturated zone, which will be sealed off with an annular space seal to prevent contamination of the sample. It is unclear how the annular seal will prevent contamination of samples. **[56Q]**

Response: The regulations were not changed in response to this comment because the intent of this subsection is to prevent contamination of a sample from a discrete sampling interval by sealing that interval off from contaminants in other zones. State Board staff feels that the wording of this subsection accomplishes this goal and is clearly written.

Comment on Subsections 2550.7(b)(4) through (b)(7):

Comment: One commentor disliked the use of the term "sampling interval" in Subsections (b)(5) and (b)(6), preferring to use the terms "screened at the appropriate depth" or "screened interval" instead. **[37P]**

Response: The regulations were not changed in response to this comment because there are some wells which are not screened but which do have a sampling interval [e.g., wells completed in

fractured rock]. The term sampling interval serves well in all instances to indicate the intent of this provision.

Comment: The phrase "and fitted with an appropriate filter pack" in Subsection 2550.7(b)(5) should be changed to "and, where necessary, fitted with a filter pack". [37Q]

Response: The regulations were not changed in response to this comment because in most cases a filter pack must be designed to meet the needs of both the slot size of the well screen and the pore-size distribution of the surrounding geologic material. If this is not done correctly, then the well cannot be developed successfully and poor sample quality is the result. It is prudent to install a filter pack even where a well is being installed in fractured igneous or metamorphic rock because of the possibility that the newly exposed rock may contribute detritus to the well bore, which may compromise the integrity of the well.

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Subsection 2550.7(c)

Specific Purpose

The specific purpose of Subsection (c) is to specify the performance standards which will be used to judge the acceptability of background and downgradient surface water sampling systems.

Factual Basis

The natural variation in the water quality of surface water bodies is typically greater than the natural variation observed in ground water. For this reason, the criteria for establishment of appropriate monitoring points and background monitoring points for surface water bodies differs from the criteria for ground water bodies.

This subsection includes the specific requirements and performance standards that apply to surface water monitoring systems in each of the monitoring and response programs under this article. These requirements are necessary to provide a clear and consistent delineation of the basic elements of an effective monitoring system for the surface water medium.

These subsections incorporate existing California requirements for surface water monitoring. In order to fit these requirements into the existing Subpart F structure a considerable amount of new language was necessary. Language from the Subpart F ground water monitoring system description, from existing Title 22, and from repealed Article 5 was used wherever possible.

Comment on Subsection 2550.7(c):

Comment: This subsection fails to utilize background or upgradient monitoring for data comparison. Without background data there is no way to determine the true source of contamination. **[42N]**

Response: The regulations were not changed in response to this comment because Subsection (c)(2)(A) requires the establishment of background monitoring points for the surface water medium and Subsection (e)(6) of this section requires background data to be collected for a period of at least one year.

Comment: One commentor correctly observed that this subsection requires the discharger to monitor affectable surface water bodies. **[4B]**

Response: The regulations were not changed in response to this comment because the comment did not request or suggest a change.

Comment: Surface water monitoring does not provide a reliable means of detecting releases from a waste management unit and should not be required as part of a detection monitoring program. **[36W]**

Response: The regulations were not changed in response to this comment because the surface water monitoring provisions of the revised article are simply a clarification of requirements in repealed Article 5, and also because any waters of the State which could conceivably be affected by a release from the unit should be monitored in the most effective manner that is possible.

Subsection 2550.7(c)(1)
The chemical characteristics of surface water typically exhibit considerable variation from one surface water body to the next. The variation between surface water bodies typically has little to do with the variation within an individual surface water body. The goal of monitoring surface water is to detect the presence of a release in a particular surface water body. In order to avoid extraneous variation in the background value, which could mask the presence of a release, this subsection requires that a separate set of monitoring points and background monitoring points be established for each susceptible surface water body.

The discharger initially proposes a list of surface water bodies which could be affected by a release from the unit. Surface water bodies that are candidates for this list will include: (1) surface water bodies that are downgradient of the unit (relative to ground water flow) and whose waters are in contact with ground water; (2) surface water bodies that are down-slope of the unit (relative to surface flow); and (3) surface water bodies that could be contaminated by a release through any other transport mechanism [e.g., vapor-diffusion of vinyl chloride laterally through the unsaturated zone, airborne transport, etc.].

Comment on Subsection 2550.7(c)(1):

Comment: We do not see the need for monitoring surface water during the detection monitoring or evaluation monitoring phases. Dischargers are already required to monitor ground water and the unsaturated zone. In addition, all waste management units are equipped with leachate collection and removal systems which are monitored. If there is a leak one or all of these monitoring systems will detect it. We see no instance where leakage would be present in the surface water and not be detected first by these other monitoring systems. In addition, large or moving bodies of water, such as oceans or rivers, will quickly dissipate any leakage from a waste management unit that reaches these bodies. It is unlikely that the leakage will be detected by sampling these bodies of water (unless it is a substantial release, which would be evident by other means). Therefore, this requirement creates additional work for the discharger which work is unlikely to provide any useful information. **[48A]**

Response: The regulations were not changed in response to this comment for the following reasons. The Porter-Cologne Water Quality Control Act clearly requires the State Board to

promulgate regulations that will protect all waters of the State from degradation due to discharges of waste to land. The actual degree of reliability of monitoring systems in the ground water and the unsaturated zone is not quantifiable but is certainly less than perfect; therefore, monitoring surface water is essential not only to detect releases but also as a direct means of protection to that medium. In addition, surface water is the most easily monitored of all media subject to the revised regulations.

Subsection 2550.7(c)(2)(A)

This subsection describes the performance standards for all background monitoring points in surface water during any program, namely that: (1) a separate set of background monitoring points is needed for each surface water body that could be affected by a release from the waste management unit; (2) samples from each such background monitoring point must be representative of the quality of the water before it has been affected by any given release; and (3) there must be enough such background monitoring points to represent spatially-correlated variability of uncontaminated water within the surface water body. These performance standards are needed to provide reliable surface water monitoring data, as needed in any monitoring and response program that addresses susceptible surface water.

In most cases, it is possible to assign background monitoring points [i.e., an assigned location and depth] in a surface water body that are as far removed as possible from the presumed point-of-entry of contamination. The number of background monitoring points required is dependent upon the degree of variability of water quality throughout the water body at any given time. If water quality varies with depth or location, then there should be enough background monitoring points to represent the total range of water quality that the surface water body exhibits at any given time. The combined data from these background monitoring points can then serve as a reference against which samples from the presumed point-of-entry can be tested. The advantage of this approach is that contemporaneous samples from the background monitoring points and the monitoring points can be tested against each other, thereby limiting the possibility that temporal variability within that water body could mask the presence of a release at any given monitoring point.

In cases where an entire surface water body is affected by a release, the background monitoring points can not be used again until after the cleanup has been accomplished. In such

circumstances, it will be necessary to rely upon background data obtained from that water body prior to its being affected by the release. A proper surface water monitoring program will provide for the monitoring of trends in the background concentration of each monitored constituent or parameter at each background monitoring point in order to avoid the possibility that one or more background monitoring points have become contaminated, a condition which would mask the presence of the release at the monitoring points.

Comments on Subsections 2550.7(c)(1) and (c)(2)(A):

Comment: These sections do not appear to be derived from any existing regulatory language or statutory requirement and the wording is unbounded as to how and where a surface water body could be affected by a release from a waste management unit.**[18W,25W]** Even though nonsensical in most cases, the wording of Subsection (c)(1) could include the ocean, as it is the ultimate destination of most releases.**[23K]**

Response: The regulations were not changed in response to this comment because their applicability is already limited to surface water bodies "that could be affected by a release". Monitoring provides the only one way to decide whether or not a surface water body has been affected by a release. If a surface water body is likely to be affected so slightly that the release could not be detected there, then that water body cannot be effectively monitored. Therefore, the monitoring methodology limits the surface water bodies that should be included in the surface water monitoring portion of the program. For example, one would not monitor the Pacific Ocean to see if a waste management unit in Sacramento has affected it. On the other hand, it would be appropriate to monitor the waters of a bay for the effects of any release from an immediately adjacent unit.

Subsection 2550.7(c)(2)(B)

This subsection contains the specific performance standard which applies to surface water monitoring points used in the Detection Monitoring Program, namely, that the monitoring points be placed to intercept a release entering the surface water body. A release, typically, is transported to a surface water body through the ground water, through the air, through surface flow, or through vapor-phase diffusion within the unsaturated zone. The likely avenues of entry that a release could follow to the surface water body will determine the number, kinds, and

placement of monitoring points within the surface water body. This subsection is necessary to ensure that the surface water monitoring system will be designed to achieve the goal of monitoring in a Detection Monitoring Program.

Subsection 2550.7(c)(2)(C)

Surface water bodies that are affected by a release from the waste management unit will be included in the Evaluation Monitoring Program to delineate the nature and extent of the release. The emphasis during an Evaluation Monitoring Program shifts from detection of a release to the design and evaluation of corrective action options and the evaluation of water quality impacts resulting from the release. This change in purpose will probably require a different surface water monitoring system than that used in the Detection Monitoring Program. The performance standard under this subsection clarifies for the discharger the goal that the discharger's proposed monitoring system must achieve for a surface water body affected by a release from the discharger's unit.

Subsection 2550.7(c)(2)(D)

Surface water bodies that are contaminated due to a release from a waste management unit will be included under the Corrective Action Program for that unit. The performance standard under this subsection reflects the need to delineate the effectiveness with which the corrective action measures are addressing the contamination in the surface water body. This subsection is needed in order to clearly outline the goal that the discharger's proposed monitoring system must achieve for a surface water body that is involved in a Corrective Action Program.

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Subsection 2550.7(d)

Specific Purpose

The specific purpose of Subsection (d) is to specify the performance standards which will be used to judge the acceptability of background and downgradient soil-pore liquid sampling systems in the unsaturated zone.

Factual Basis

Subsection (d) delineates the specific requirements and performance standards for unsaturated zone monitoring systems in each of the monitoring and response programs under this article. These requirements are necessary to provide a clear and consistent delineation of the basic elements of an effective monitoring system for the unsaturated zone medium. Unsaturated zone monitoring provides the earliest possible indication that a release is emanating from the waste management unit; therefore, a properly designed unsaturated zone monitoring system acts as the first line of defense against threats to human health and the environment resulting from a release. The unsaturated zone medium provides certain unique challenges to effective monitoring which must be considered in the design and operation of any system for monitoring that medium, including but not limited to: the pore-size distribution of the medium; the ease with which samples can be withdrawn; the limited radius of influence of sample-producing devices [e.g., lysimeters]; the inability to obtain samples in cases where the medium is too dry to be overcome by the suction induced in the sampling device; the thickness of the medium [i.e., the depth to ground water]; and the effectiveness with which non-sample-producing methods could detect a release [e.g., neutron probe technology]. The performance standards which constitute these subsections are intended to require the discharger to take these factors into consideration when designing and proposing unsaturated zone monitoring systems.

These subsections incorporate California's requirements for unsaturated zone monitoring under Section 2559 of repealed Article 5. In order to fit these requirements into the existing Subpart F structure, a considerable amount of new language was necessary. Language from the Subpart F ground water monitoring system description, from existing Title 22, and from existing Chapter 15 was used wherever possible.

Comments on Subsection 2550.7(d):

Comment: Unsaturated zone monitoring is an unproven science and monitoring equipment for this application is inadequate to obtain representative samples without bias of data, therefore, the unsaturated zone monitoring requirements should be deleted. **[18Z,25Z]**

Response: The revised regulations were not changed in response to this comment for the following reasons. Unsaturated zone monitoring is presently required under repealed Article 5, except where it is infeasible [Subsections 2550(a), 2553(a), 2556(a), 2557(a), and 2559(a)]. The requirements of revised Subsection 2550.7(d) are a clarification of the unsaturated zone requirements of repealed Article 5. Unsaturated zone monitoring is essential because it provides the earliest warning of leakage from a waste management unit, and because it provides the opportunity to detect a release before it has reached ground water. For this reason it is required in revised Article 5 at all waste management units unless it is technically infeasible to install (e.g., beneath some existing units), or unless the discharger can show that such monitoring will give no indication of a release. Even in situations where sample-producing methods are of little use, non-liquid-recovery technology (e.g., neutron probes) can be extremely useful in detecting and isolating areas of anomalously-high moisture content in the soil underlying the unit.

Comment: Unsaturated zone monitoring is not technically feasible, therefore, the term "monitoring point" should not include reference to a "device" at which monitoring is conducted and should omit any other reference to the unsaturated zone. **[18BS,18BN,25BS,25BN]**

Response: The regulations were not changed in response to this comment for the following reasons. Unsaturated zone monitoring is mandatory whenever it is technically feasible. Lack of technical feasibility is not assumed but must be proved by the discharger in each case because the extremely valuable early warning this monitoring technology can give has no substitute. When it is feasible, the unsaturated zone will be monitored through the use of unsaturated zone monitoring devices such as lysimeters or neutron probes. Therefore, no change in the revised language is warranted.

Comment: The revised regulations should allow dischargers to terminate unsaturated zone monitoring following confirmation of a release and should establish a more realistic standard for waiver of unsaturated zone monitoring requirements. **[36X]**

Response: The regulations were not changed in response to this comment because the utility of unsaturated zone monitoring does not stop with the discovery of a release and because this form of

monitoring is so valuable in its capacity to give an early warning of a release that it should be required whenever feasible. Subsequent to the detection of a release, the unsaturated zone monitoring system is useful for two purposes: detecting changes in the nature of the release, such as the arrival of constituents not yet found in the ground water or the verification that source control measures have been effective in stopping the release; and this system can be of great value in detecting new releases from other portions of the unit. In addition, there will be instances in which the Regional Board will direct the discharger to clean up the unsaturated zone itself (e.g., vapor extraction of volatile organics), thereby making unsaturated zone monitoring necessary to validate the success of the corrective action measures taken.

Comment: All dischargers should not be required to perform unsaturated zone monitoring if saturated zone monitoring can be shown to be sufficient. **[41P]**

Response: The regulations were not changed in response to this comment because in cases where unsaturated zone monitoring is capable of detecting a release, it is capable of doing so at a substantially earlier time than can a ground water monitoring system. Therefore, the ground water monitoring system, acting alone, is not "sufficient" in such cases. Subsection (d)(5) of this section provides the regional board with the freedom to eliminate unsaturated zone monitoring in cases where it will not provide an early indication of a release or, for existing units, where installation of such a system is not technically feasible.

Subsection 2550.7(d)(1)

Unsaturated zone monitoring provides the earliest indication of a release. Such early indication is necessary for the protection of human health and the environment because early detection enables the Regional Board and the discharger to take remedial action on a small scale before major impacts to water quality occur. In some cases, detection in the unsaturated zone can enable corrective action to be achieved before the release even reaches ground water. Therefore, unsaturated zone monitoring is a necessary component of an overall waste management unit monitoring network.

Subsection 2550.7(d)(2)

The goals of the various monitoring and response programs differ, therefore, the unsaturated zone monitoring system for a Detection Monitoring Program is unlikely to meet the needs of an Evaluation Monitoring or Corrective Action Program. This subsection is necessary in order to help organize the differing performance standards for unsaturated zone monitoring systems in each program.

It is extremely difficult to install unsaturated zone monitoring devices after a waste management unit is constructed. The unsaturated zone monitoring system cannot normally be retro-fitted subsequent to a release in order to update the system to meet the performance standards of the Evaluation Monitoring or Corrective Action Programs. It is, therefore, anticipated that the Regional Board will require that the unsaturated zone system installed during construction of the unit be capable, to the greatest extent feasible, of satisfying the unsaturated zone monitoring performance standard of any of the monitoring and response programs. The regional board has the authority, pursuant to Subsection 2550.1(b) of this article, to require portions of the Evaluation Monitoring and Corrective Action Program to be prepared ahead of their time of need. It is expected that the Regional Board will invoke this authority when considering the discharger's initial proposal for an unsaturated zone monitoring point layout so that, in the event of a release, the needed monitoring points will be available regardless of which program the discharger is placed into. These subsections provide the discharger with a clear insight into the requirements that the discharger's proposed unsaturated zone monitoring program must fulfill during the various monitoring and response programs.

Subsection (d)(2)(A) sets out the performance standard for background monitoring points, namely, that the system of background monitoring points be capable of representing the quality of soil-pore liquid that is unaffected by a release from the unit. This requirement applies during all monitoring and response programs. Background data meeting the requirements of this subsection are necessary for use as a basis of comparison with data collected from locations in the unsaturated zone that would be impacted if a release occurred. Before a release occurs, the best background data will come from directly beneath the unit, preferably prior to discharging waste to the unit. However, background soil-pore liquid monitoring points beneath the unit are subject to contamination if a release occurs. The availability of quality background data should not be subject to

interruption in case of a release from the unit. One way the discharger could comply with this subsection is to establish a correlation early on in the Detection Monitoring Program between background soil-pore liquid from beneath the unit and soil-pore liquid from a nearby background plot having soils similar to those underlying the unit. In this way, the discharger will be able to represent the background soil-pore liquid beneath the unit whether or not a release has occurred. This subsection is necessary to provide the discharger with a description of the performance standard by which the discharger's proposed soil-pore liquid background monitoring point network will be judged.

Subsection (d)(2)(B) describes the performance standard that must be achieved by the system of unsaturated zone monitoring points used during a Detection Monitoring Program. The unsaturated zone monitoring system is adequate if it can provide a reliable, early indication of a release from any region of the waste management unit. This requirement is necessary to provide the discharger with a clear description of the standard by which the discharger's proposed unsaturated zone monitoring point system will be judged.

Subsection (d)(2)(C) reflects the change in emphasis during an Evaluation Monitoring Program, when the focus shifts from detection of a release to delineation of the nature and extent of the release for purposes of developing appropriate corrective action measures that will combat the negative effects of the release. The performance standard under this subsection clarifies for the discharger the goal that the discharger's proposed unsaturated zone monitoring system must achieve during an Evaluation Monitoring Program, even if that system must be installed ahead of need.

Subsection (d)(2)(D) outlines the performance standard that applies to that subset of the discharger's system of unsaturated zone monitoring points which is included in a Corrective Action Program. As with any monitoring system, compliance with the water quality protection standard at the monitoring points in the unsaturated zone is assumed to indicate compliance with that standard at all unmonitored locations between the monitoring points. During a Corrective Action Program, the unsaturated zone monitoring system must be capable of verifying that the corrective action measures are effectively bringing the soil-pore liquid back into compliance with the water quality protection standard at all portions of the unsaturated zone that have been affected by the release. An unsaturated zone monitoring system suitable for meeting this performance standard

must, therefore, have a sufficiently dense array of monitoring points that the medium can be declared clean throughout if the monitoring points produce clean soil-pore liquid samples. The performance standard under this subsection clarifies for the discharger the goal that the discharger's proposed unsaturated zone monitoring system must achieve during a Corrective Action Program, even if that system must be installed ahead of need.

Subsection 2550.7(d)(3)

As discussed under Subsection (d)(1) of this section, there is a need to have a background plot in addition to taking initial background monitoring data from the unsaturated zone beneath the unit. The background information from these two locations serves to establish a correlation between the soil-pore liquid underlying the unit and that produced at a nearby background monitoring location which will be used after a release has been detected. This section is necessary to explicitly require the discharger to include such a plot in the discharger's proposed unsaturated zone monitoring program so that a reliable correlation can be developed, ahead of the time of need, between the untainted soil-pore liquid underlying the unit and that at the plot.

Subsection 2550.7(d)(4)

There are instances in which sample-producing devices, such as lysimeters, cannot be relied upon to produce samples of soil-pore liquid from the unsaturated zone. However, in this situation some other form of unsaturated zone monitoring may exist which can provide reliable indications that a release has occurred. These alternative methods are often best used in conjunction with the sample-producing methods, however, they can still serve a valuable purpose even in cases where it is not possible to use sample-producing technology at all or at certain times during the year.

One such non-liquid recovery method involves the use of neutron probes. Another is the use of gypsum blocks or resistivity nets. In locations where the vadose zone is typically too dry to produce samples to lysimeters, a system of pressure-vacuum lysimeters can be installed and the bulbs can be wet-up with deionized water during each sampling episode. In such a typically-dry environment, if a sample were produced in the absence of a general wetting of the vadose zone regionally by a storm, the very production of a sample may be indicative of a release and warrants further investigation through laboratory analysis of the sample produced.

This subsection is necessary to specifically require the discharger to consider and propose a suite of unsaturated zone monitoring approaches that are appropriate for use beneath the waste management unit, rather than to rely solely upon techniques that involve soil-pore liquid recovery. The high value of early detection of releases in the unsaturated zone necessitates that a variety of unsaturated zone monitoring system be used where that variety increases the chance of detecting a release in its early stages.

Subsection 2550.7(d)(5)
It is necessary to preclude needless expenditure of the discharger's resources in those rare cases where no form of unsaturated zone monitoring is technically feasible. As such, an exemption from the requirement for unsaturated zone monitoring is necessary.

Comment on Subsections 2550.7(d)(4) and (d)(5)

Comment: These subsections present the various means for obtaining an exemption to unsaturated zone monitoring [UZM] in an unnecessarily repetitious and confusing manner. Such exemptions should be located in the same subsection and should avoid repetition. **[68E{page 3}]**

Response: The regulations were not changed in response to this comment for the following reasons. The UZM waiver provision in Subsection (d)(4) needs to be listed separately from those in Subsection (d)(5) because the former applies **only** to liquid recovery types of UZM, whereas the waiver provisions of Subsection (d)(5) apply to UZM in general [not just liquid recovery types], with separate provisions being necessary for new versus existing waste management units -- new waste management units can only be given a waiver if UZM devices will not work, but existing units can have a waiver for that reason or for avoiding having to move permanent structures. This differentiation is necessary in order to clearly delineate the circumstances in which the various types of UZM must be installed in new and existing units. Combining these provisions into a single subsection would cause unnecessary confusion.

Comment on Subsection 2550.7(d)(5):

Comment: The exemption language of this subsection is well written and should not be deleted.[2F]

Response: In accordance with this comment, the exemption provided in this subsection has not been deleted.

Comment: The unsaturated zone beneath a waste management unit is the percipient indicator of leakage from the unit. Its great value is that it can warn of incipient ground water contamination even before such contamination occurs, thereby both protecting water quality and reducing cleanup costs.[17E]

Response: The regulations were not changed in response to this comment because the regulations are already drafted to reflect this perspective.

Comment: This subsection should provide an exemption for unsaturated zone monitoring at woodwaste sites.[23L]

Response: The regulations were not changed in response to this comment for the following reasons. The Regional Board has the discretion to determine that the waste at the unit poses no potential threat to beneficial uses of waters of the state and that no monitoring should be required, including the requirement to carry out monitoring of the unsaturated zone underlying the unit. However, if the Regional Board determines that the waste does pose such a potential threat, then the unit is a classified waste management unit and all portions of Article 5 applies. Under such circumstances it would be unreasonable to eliminate unsaturated zone monitoring from the monitoring and response programs for the unit.

Comment: This subsection should have additional language providing for the elimination of unsaturated zone monitoring if it is not technically applicable.[16H,12Q] All new sites will be forced to monitor the unsaturated zone, whether or not it is feasible. Monitoring points installed through the waste may lead to loss of integrity to the LCRS.[56S] This subsection gives too much emphasis to a heretofore relatively unreliable form of monitoring; therefore, this emphasis should be replaced by more reliance on ground water monitoring.[12P] The regulations should provide for the possibility of a waiver of unsaturated zone

monitoring requirements at those sites at which such monitoring will not provide useful information and should also provide consideration for the fact that this medium commonly provides limited sample volumes.**[26E]** This subsection requires unsaturated zone monitoring at all new waste management units unless the discharger can demonstrate that monitoring cannot provide any indication of a release from that waste management unit. This condition should also be applied to existing waste management units so that the regional board shall require unsaturated zone monitoring unless it is not technically feasible or cannot provide any indication of a release from that waste management unit.**[60A]** The "technical feasibility" requirement applied to existing units should also be applied to new units.**[61C]** The provisions of this subsection should be based upon the installation being "technically and economically feasible".**[63B]**

Response: The regulations were changed in response to these comments in order to clarify the conditions under which unsaturated zone monitoring [UZM] should be required; however, the basic requirement to install a UZM system is retained for the following reasons. Unsaturated zone monitoring has the potential to provide the earliest possible warning of a release from a waste management unit; therefore, it should be required unless the discharger can demonstrate that there is no UZM device that will work in the subsurface conditions at the unit or, for existing units, that the installation of a UZM system would require unreasonable movement [or dismantling] of the permanent structures.

Limited sample volumes may restrict the types of analyses which can be carried out upon the samples obtained, but what can be done should be done. In cases where samples are difficult to obtain, non sample-producing forms of unsaturated zone monitoring can be especially useful.

This subsection, as modified, provides the regional board with adequate discretion to eliminate non-useful forms of unsaturated zone monitoring in all appropriate instances.

Comment: The provisions of this subsection would be useless and expensive after a release has been identified. The regional board should have the discretion to determine when the application of unsaturated zone monitoring [UZM] technology is no longer appropriate.**[63C]**

Response: The regulations were not changed in response to this comment for the following reasons. In almost all cases, a release from a unit will emerge from a discrete location in the liner. The provisions of this article are designed in such a way that a Detection Monitoring Program continues in those portions of the unit that have not been affected by the release. Unsaturated zone monitoring is useful in these previously-unaffected areas to indicate the presence of a new release. After all, the presence of one release does not preclude the development of a subsequent release from another location in the unit. In addition, the UZM devices which are affected by a release are useful in helping to delineate the nature and extent of the release, during Evaluation Monitoring, and in verifying that source-control remediation measures required in Corrective Action have been successful. Therefore, there is no reason to restrict the use of UZM devices to units which have detected no release.

Comment: This subsection only allows a variance to unsaturated zone monitoring if such monitoring would give no indication of a leak, whereas repealed Article 5 only requires proof of infeasibility. The proposed variance is much more stringent than the existing one and this change is not addressed in the Statement of Reasons. **[31G]** Subsection (d)(5) establishes a standard for waiving unsaturated zone monitoring that is nearly impossible to meet. This appears to be an abandonment of the feasibility standard under Subsection 2559(a) of repealed Article 5. **[36Y]** Unsaturated zone monitoring variances should be based upon the infeasibility of implementing this type of technology at either new or existing units. **[24A]** Existing units should not be forced to retrofit with an unsaturated zone monitoring system because this could cause damage to the unit. **[48B]**

Response: The regulations have been changed in response to these comments so that the regional board can provide a variance from unsaturated zone monitoring to units that are already in existence prior to the effective date of the revised article using the feasibility basis, because such units would typically have to be removed and then rebuilt after installing the unsaturated zone monitoring system. However, the "effectiveness" standard is retained for use with new units because the value of the early warning provided by unsaturated zone monitoring makes its use essential in any case where it can provide that early warning. If no form of unsaturated zone monitoring device can be made to work in a particular subsurface

environment, then the discharger should have no trouble providing sufficient proof to obtain a variance. By the same token, it would be poor stewardship of the ground water resource to permit such a variance when unsaturated zone monitoring could have detected a release in its early stages. If such monitoring will provide an early indication of a release, then it should be included in the design for a new unit because the long delay typical of indication via the ground water medium enables a very large release to develop before any steps can be taken to counter the damage.

Comment: Retro-fitting existing waste management units with unsaturated zone monitoring systems could be technically and economically impractical as well as imprudent. **[12R,16I]**

Response: In response to this comment, the regulations have been changed to provide the Regional Board with the flexibility to eliminate all or part of the unsaturated zone monitoring requirements at existing waste management units if the discharger can show that the installation of the system would necessitate moving permanent structures.

Comment: Waivers from unsaturated zone monitoring should be based on the limits of available techniques given local soil conditions. **[42O]**

Response: In response to this comment, the final version of the regulation contains waiver language which includes consideration of the local conditions.

Comment: The response given in the SOR does not fully address the points made in previous comments, namely, that soil-pore-liquid sampling methodology is a problematic procedure. A "where technically feasible" stipulation should be added. **[56R]**

Response: Although Subsection (d)(5) was not changed in response to this comment because the comment did not apply to changes since the previous comment period, the regulation has been subsequently modified to clarify the conditions under which unsaturated zone monitoring is required.

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Subsection 2550.7(e)

Specific Purpose

The specific purpose of Subsection (e) is to group together under one subsection all general requirements and performance standards which govern how the monitoring systems and statistical methods shall be used to fulfill the monitoring performance goal of each monitoring and response program [i.e., the Detection Monitoring, Evaluation Monitoring, and Corrective Action Programs].

Factual Basis

Subsection 2550.7(e)(1)
This subsection requires that a qualified professional be responsible for designing and installing the monitoring systems in accord with the requirements of this article in order to assure that the performance standards of this section will be met. This subsection is retained from repealed State regulations [Subsection 2555(b) of Article 5].

Subsection 2550.7(e)(2)
Subsection (e)(2) is retained from repealed State requirements [23 CCR 2555(d)] because the description of subsurface materials must be consistent with established professional standards if the description is to be of any use in inferring geologic and hydrogeologic conditions. Boring logs constitute one of the few means with which a geologist can discern the geologic and hydrogeologic conditions underlying a site. A geologist has specific training in the classification and correlation of subsurface strata based upon the limited data available from boring logs, however, even the best geologist will be unable to design or validate a monitoring network if the boring logs are of poor quality or do not contain all needed information. Therefore, it is reasonable to require that a registered geologist be responsible for the quality of the boring logs because such an individual has the capacity to notice and record all relevant data from each boring in a manner that will be useable to other geologists who may need to analyze the site later. Such information can only be gathered during drilling and may have a profound influence upon the design of all monitoring systems for that unit.

The inclusion by reference of the Bureau of Reclamation's version of the Unified Soil Classification System is discussed in the introduction to this Statement of Reasons.

Comments on Subsection 2550.7(e)(2):

Comment: The logging of soils is required for a variety of activities at solid waste disposal facilities. ASTM Designation: D2488-84 [1/89] method for visual classification, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) as incorporated by reference in 14 CCR 17774(f) and 17783.5 should be substituted for the Unified Soils Classification System [USCS] used by the State Water Board. The USCS proposed is a laboratory classification system not a field classification system. If a laboratory classification system is intended, then ASTM Designation: D2487-85 [1/89], "Standard Test Method for Classification of Soils for Engineering Properties", as incorporated in 14 CCR 17774(e)(1)(C), should be substituted instead. Although these two methods are similar, they are not **the same**, so the State Water Board should adopt the same standards as the Waste Board in order "to be consistent with other provisions of existing State law **[sic]**." Under the best of circumstances this difference would be confusing to the public and regulatory agencies alike. In the worst case, the discharger/operator would be required to describe the same soil sample using both classification methods, which is unnecessary and unduly burdensome. **[59E,68F{pages: 3-4}]**

Response: The regulations were not changed in response to this comment for the following reasons. Counter to the indication of the commentor, the USCS method incorporated by reference in the revised article contains both field and laboratory methods. These methods have been carried over from repealed Article 5 because their use proved beneficial in characterizing the regolith underlying classified waste management units. This Waste Board comment provides no documentation that the ASTM methods are in any way superior, yet admits that the two methods are nearly identical. In December 1984, the State Board specified in its Chapter 15 regulations the use of the USCS. Since that time the Waste Board has adopted regulations specifying use of the very similar ASTM system, thereby introducing unnecessary confusion. It would seem that the Waste Board is not following its own advice.

Comment: Subsection (e)(2) duplicates the provisions of Subsection (b)(3) of this section and should be eliminated. **[59G]**

Response: The regulations were not changed in response to this comment for the following reasons. Subsection (b)(3) addresses **driller's logs**, which are relatively non-technical documents required by the Department of Water Resources, whereas Subsection (e)(2) addresses **registered geologist's boring logs** and in addition specifies the method of description [Unified Soil Classification System, etc.], a requirement which is absent from Subsection (b)(3). Therefore, the subsections are not mutually duplicative.

Comment: Subsection (e)(2)(A) mentions the Unified Soil Classification System which should be incorporated by reference. **[42P]**

Response: The regulations have been changed in accordance with this comment.

Comment: Subsection (e)(2)(C) requires that the depth and thickness of saturated zones encountered during the drilling of a monitoring well be noted "where possible". A better requirement would be tied to the elevation of the potentiometric surface. **[18AJ,25AJ]** Subsection (e)(2)(C) makes delineation of a saturated zone optional. Without knowledge of the saturated zones operators cannot be expected to screen and install wells that will intercept any possible contaminants as early as possible. **[42R]**

Response: The revised regulations were not changed in response to this comment because Subsection (e)(2)(C) is intended solely for the identification of saturated zones encountered during the drilling of borings. It is not intended to require the determination of potentiometric surfaces, as this is an activity that is more properly done subsequent to well completion. The "where possible" provision is necessary in order to accommodate those drilling conditions under which it is not possible to determine the depth and thickness of saturated zones [e.g., mud rotary drilling method, etc.].

Comment: Subsection (e)(2)(B) should establish consistent standards for description of rock, in a similar manner to the way the Subsection (e)(2)(A) does for soil. **[36Z]**

Subsection (e)(2)(B) requires that descriptions of rocks be "appropriate" for geologic investigations. This standard requires more specific criteria, and perhaps the incorporation by reference of a technical guide.**[42Q]**

Response: The regulations were not changed in response to these comments because the wide variation in rock type, when coupled with the varying goals which a subsurface investigation might have, makes it inadvisable to specify a single rock classification system. One of the reasons for requiring that this work be accomplished by a registered geologist is that such persons are well trained in rock description and can choose the most appropriate rock classification system. The use of a prescriptive standard in this regulation would be inappropriate.

Comment: Revised Subsection (e)(2) precludes a qualified geotechnical engineer [QCE] from logging borings. This is contrary to the practice regarding underground storage tank investigation under 23 CCR 2648(t), where either a registered geologist or a QCE is allowed to supervise monitoring well installation. In addition, it is contrary to the "Fields and Expertise" memorandum prepared jointly by geological and geotechnical professionals which clearly allows that although a QCE cannot log rock material or do down-hole observations for structure geometry, the QCE can log soil borings.**[38A]** Geotechnical engineers should be allowed to be responsible for logging borings because geotechnical engineers have the training to do so and are required by law to demonstrate that capability in order to obtain their geotechnical engineering registration.**[43A]**

Response: The regulations were not changed in response to this comment for the following reasons. Subsurface investigations at classified waste management units are much more extensive (both laterally and vertically) than that typically carried out for a leaking tank investigation. In most instances the underlying rock units must be penetrated by the borings; therefore, it would not be appropriate to have to allow a civil engineer to carry out this work because that would often necessitate changing supervision on a partially completed boring each time there is a change from unconsolidated materials [e.g, soil] to consolidated rock. In addition, on-site geological interpretation of the soil overlying any soil/bedrock interface must be made in the context of an understanding of the depositional environment in which the soft sediments making up the soil were deposited, with special regard being given to the degree of likelihood that the

penetrated geologic unit will pinch out within a short distance of the borehole. Geologists are trained in the use of inference based on this sort of information. Without this understanding, information essential to the creation of reliable stratigraphic correlation between the various borings at or surrounding the facility will likely be overlooked, resulting in a much less effective site investigation.

Subsection 2550.7(e)(3)

Subsection (e)(3) allows the controlled use of certain cost-saving measures by a discharger having a facility with more than one waste management unit. It differs from the analogous provisions of 40 CFR 264.97(b) in that the federal provision restricts the application of this option by requiring that a release be detected in the uppermost aquifer at the point of compliance, whereas this subsection retains the requirement in repealed Article 5 that the ground water monitoring system enable the earliest possible detection and measurement of waste constituents that have leaked from the units. This subsection permits the cost-saving advantage of a monitoring system shared in its entirety between contiguous waste management units, but restricts its application to circumstances in which none of the sharing units will have a decrease in monitoring efficiency as a result. For example, if the detection of a release from any one of the units would be delayed because of the shared monitoring system [i.e., the upgradient unit is further from the shared monitoring points than is the downgradient unit], then additional monitoring points would need to be added that were specific to the unit most distal the shared monitoring points. Such a system would not then be totally shared, so would not qualify under this subsection. It should be noted, however, that this subsection addresses only totally shared monitoring systems. It does not preclude contiguous or non-contiguous units from sharing one or more monitoring points, so long as each such shared monitoring point is addressed separately in the monitoring program for each unit. Likewise, the sampling and analysis schedule for such a shared monitoring point can be adjusted to avoid redundant analyses so long as the monitoring program at each unit receives all the data it needed and in a timely manner.

This subsection is necessary to enable the Regional Board to evaluate the entire monitoring program as an integrated unit and to assure that the use of a shared monitoring system does not impair the ability to detect a release from any one of the waste management units involved.

Comment on Subsection 2550.7(e)(3):

Comment: Language needs to be modified to clearly state which is a unit and which is a group of units. **[29E]**

Response: The regulations were not changed in response to this comment because after due consideration the language of this subsection was determined to be sufficiently clear on this point. The regulations under Chapter 15 have no location in which a group of waste management units is treated as a single unit, as the federal regulations do under the "waste management area" concept. Instead, the regulations under Chapter 15 are specific to each individual waste management unit. Revised Article 5 retains this approach. Subsection (e)(3) enables a **system** of monitoring points to be shared by various units, but each unit must have its own monitoring program, thereby enabling each unit to have different Monitoring Parameters, Constituents of Concern, and even monitoring schedules.

Comment: Subsection (e)(3) inappropriately limits a discharger's ability to use shared monitoring systems for waste management units that are located in the same vicinity. **[30F,36AA]**

Response: The regulations were not changed in response to this comment because the language in revised Subsection (e)(3) is a clarification of a requirement under Subsection 2553(c) [of repealed Article 5] which is worded in a somewhat confusing manner. Contiguous waste management units can often share an entire monitoring system effectively, due to their close proximity, but each unit should have its own monitoring program(s) even if the system is shared. Waste management units that are not touching may be able to share a few monitoring points effectively, but should otherwise be provided with unit-specific monitoring points because few flow lines in the ground water will pass under both units. In cases where units are lined up in a row parallel with the direction of ground water flow, the requirement to provide the earliest possible detection and measurement of a release is best served by having at least some monitoring points immediately downgradient of each unit.

Subsections 2550.7(e)(4) and (e)(5)
If the monitoring effort is to produce data to demonstrate that the waste management unit is protective of human health and the environment, the data must be as representative as possible of the in-situ water in the monitored medium. To accomplish this goal, sampling and analytical procedures and laboratory analytical methods must be integrated in all monitoring and response programs. Just as a chain is no stronger than its weakest link, so too is monitoring data no better than the most poorly executed step in its production. These subsections require that each step in the production of monitoring data for a program be included in the Waste Discharge Requirements for that program. In this way all steps involved in the production of water quality monitoring data will have undergone the review and consideration necessary for reliability.

Comments on Subsections 2550.7(e)(4) and (e)(5):

Comment: Subsection (e)(4) is inadequately detailed with regard to quality assurance/quality control [QA/QC] procedures. **[42S]**

Response: The regulations were not changed in response to this comment because the scope of this rulemaking does not include the promulgation of detailed requirements for QA/QC.

Comment: The requirements of Subsection 2550.7(e)(4)(A) [sample collection procedure] should include a description of purging techniques, sampling equipment and decontamination of sampling equipment. **[18AB,25AB]**

Response: The regulation has been changed in accordance with this suggestion.

Comment: The phrase "Constituent of Concern and the concentration or value of each" should be eliminated from Subsection 2550.7(e)(5). **[37R]**

Response: The regulations were not changed in response to this comment because Constituents of Concern are the primary focus of the monitoring effort. The fact that the more limited suite of Monitoring Parameters are used as a surrogate for the Constituents of Concern does not relieve the discharger of the responsibility of providing appropriate sampling and analytical methods for the Constituents of Concern because each Constituent

of Concern must be individually tested for in the event that a release is indicated by analysis of the Monitoring Parameters.

Comment: Subsection (e)(5) should be revised to read "...methods for ground water, surface water, and/or the unsaturated zone..." [41Q]

Response: The regulations were not changed in response to this comment because all water-bearing media that are monitored pursuant to this article must be assigned appropriate sampling and analytical methods for each constituent or parameter monitored in that medium.

Subsection 2550.7(e)(6)

The reliability with which a monitoring program can discern a release is a function of both the accuracy with which the background data reflects the in-situ water quality in the monitored water body and the suitability of the statistical method for the data to which it is applied. For this reason, this subsection requires the discharger to collect enough water quality data from the monitored media at the waste management unit to establish background value for each Constituent of Concern or Monitoring Parameter, and to enable the discharger to propose appropriate statistical techniques for use in data analysis throughout the remaining duration of the monitoring effort at the unit. The requirements of this subsection are necessary to clearly indicate the minimum preparatory steps the discharger must take towards satisfying the statistical performance standards.

Comments on Subsection 2550.7(e)(6):

Comment: The minimum sampling frequency, under Subsection 2550.7(e)(6), should be changed from quarterly to every six weeks and provisions for more frequent sampling should be included for units located in geologically or hydrogeologically complex areas. [670 (page 23)] Subsection 2550.7(e)(6) requires the discharger to collect all data necessary for selecting the appropriate statistical method pursuant to Subsections (e)(7-9) of that section; however, a strict reading of this item would allow only nonparametric tests because methods which assume approximate normality (i.e., parametric tests) would require more data than any discharger

could collect. An unfortunate aspect of this language is that the discharger can choose (from among the tests listed in Subsections (e)(8)(A-E) of this section) the test which most suits his purposes, supporting the choice by some plausibility arguments; the burden of proving that the method chosen is not appropriate then falls upon the local groundwater purveyor. **[67U {pages: 54,70}]**

Response: The regulations were not changed in response to these comments because this subsection was not open for public comment at the time these comments were submitted [this subsection has not been changed since the article was first noticed on June 23, 1989].

In addition, Comment 67O does not provide any compelling argument in favor of changing the minimum sampling frequency from the quarterly minimum required under the December, 1984 version of the article. The regional board is not constrained from requiring more frequent sampling, as appropriate.

Although Comment 67U is directed specifically at this subsection, the commentor made similar arguments in reference to other portions of the article that were open for comment. The reader is directed to the response to Comments 67A and 67P [under the heading "**Comments on Statistical Sample Size [i.e., the Number of Individual Samples Used in the Statistical Analysis] or Sampling Frequency**" in the Introduction to this Statement of Reasons.]

Dr. Neil Willits, State Board statistical consultant, had the following to say regarding these comments.

> **Concerning Comment 67O:** "It's my understanding that it's the regional board's discretion if they want to require additional sampling. The quarterly samples represent a minimum, and are in agreement with our discussions with Jim Brown. From a statistical standpoint, it's always better to have more data than less data, but this comment is made in the absence of cost considerations."
>
> **Concerning Comment 67U:** "My understanding was that the presumption was that the data were reasonably normal, in the absence of evidence to the contrary. If this is accurate, then their comment doesn't make sense. Their ability to recommend a technique that's to their liking would depend on whether they could make an argument that this method was preferable to a more standard method, such as ANOVA or prediction intervals based on the raw data."

Comment: Because background water quality can vary over the year [or over several years], this subsection should require background to be monitored for **at least** one year.**[48I]**

Response: The regulations were not changed in response to this comment because Subsection 2510(a) of Article 1 of this chapter clearly states that the requirements in this chapter are minimum standards and that the regional boards may impose more stringent requirements to accommodate regional and site-specific conditions.

Comment: The last sentence of Subsection (e)(6) requires soil-pore liquid data collection from beneath a new unit before it is constructed. This is too limiting. Saturated zone sampling may prove more revealing of background water quality. This section should allow more flexibility.**[41R]**

Response: The regulations were not changed in response to this comment because ground water quality is not likely to be a good indicator of the quality of soil-pore liquid beneath the unit prior to discharger of waste because the makeup of soil-pore liquid is usually quite different from that of the underlying ground water. The only way that one can know the quality of unaffected soil-pore liquid beneath the unit **with certainty** is to sample it prior to discharge. See also the response to comment 41P in this SOR, addressing Subsection (d) of this section. [See also the response to comment 41P in this SOR, addressing Subsection (d) of this section.]

Comment: The time-frame for sampling at the "times of expected highest and lowest elevations of the ground water surface" is unclear.**[18AC,25AC]**

Response: The regulation has been changed to clarify that the "times of expected highest and lowest" water table elevation is on a yearly basis. It is reasonable to expect that the discharger should know ahead of time the respective months having the highest and lowest ground water elevations because this is the sort of information that would be included in the hydrogeologic assessment required as part of the initial Report of Waste Discharge, pursuant to Section 2595 of this chapter.

Comment: The wording of this subsection essentially requires new sites to complete a year of background sampling prior to submitting a report of waste discharge. **[37S]**

Response: The regulations were not changed in response to this comment because the inference of the comment is not borne out by the wording of this subsection. Although a new site is required to take at least a year of background data, this is **not** required prior to submitting a report of waste discharge. Instead, the discharge of waste to the unit is delayed for a year while background data is accumulated, if this data has not already been accumulated. This is a reasonable requirement considering the high value of reliably obtaining an untainted reading of background water quality before any waste could conceivably affect the data.

Subsection 2550.7(e)(7)

This subsection requires that the discharger propose a separate statistical method for each constituent or parameter in each monitored medium because each constituent is likely to have a background concentration which differs from that of the other constituents and fate and transport characteristics which vary independently of the other constituents. It often happens that the background concentration of a waste constituent is not detectable, or is detectable only qualitatively. Under such circumstances, the statistical method chosen will need to be able to address non-numeric data [i.e., "non-detect" and/or "trace" values], because such values are valid indications and cannot be disregarded without degrading the reliability of the statistical test. This subsection is necessary in order to provide the discharger with a clear description of how the various statistical requirements under this section apply to the statistical proposals the discharger must make for use in evaluating the monitoring data for each Constituent of Concern and each Monitoring Parameter in each of the monitored media.

Comments on Subsection 2550.7(e)(7):

Comment: In this subsection and in many other subsections in the revised article the language "statistically significant evidence of a release from the waste management unit" is used. However, it is not strictly accurate. We do not determine if there has been a release [e.g., a tear in the liner], but rather determine if there has been an increase in the concentration of Monitoring

Parameters or in Constituents of Concern over background concentrations. We therefore recommend that you consider using the following: "statistically significant change in the concentration of a constituent or parameter". **[48J]**

Response: The regulations were not changed in response to this comment because the subject phrase correctly expresses the implication of the statistical test results. The express purpose of doing a statistical analysis on the monitoring data is to determine if there is any indication that a release has occurred. If the statistical test indicates that downgradient water has elevated concentrations relative to background water, then this constitutes evidence [but not proof] that a release has occurred. Actual proof of the release is obtained during the subsequent investigation [i.e., initiate evaluation monitoring].

Comment: Two commentors found it redundant that this subsection and Subsections (e)(9)(C) and (e)(9)(D) all require regional board approval of various facets of the statistical proposal. **[18AE,25AE]**

Response: The regulations were not changed in response to this comment because each of the references to regional board approval are needed. Subsection (e)(7) requires the discharger to propose statistical methods and states how these methods will be used after the regional board has approved of them. This sets the context of the proposal and does not specifically call for regional board approval. Subsections (e)(9)(C) and (e)(9)(D) require specific regional board approval that particular aspects of these two method-specific performance standards have been complied with. This arrangement, therefore, does not require redundant approvals of the regional board.

Comment: This section should be specific as to where the statistical methods referenced are found in the regulations. **[18AF,25AF]**

Response: The revised regulations were not changed in response to this comment because this subsection already contains a specific reference to the statistical methods: "...statistical methods specified in Subsection (e)(8) of this section...."

Comment: The word "quantification" should be replaced with the term "quantitation" in the two places it occurs in this subsection. **[27A53d]**

Response: In response to this comment, the suggested change has been made to the regulations.

Comment: Subsection 2550.7(e)(7) appears to be written under the assumption that regional board staff will be able to effectively review the statistical proposals presented. **[37T,41S]** If a discharger refuses to propose a proper set of statistical methods, then the regional board cannot meet its obligation of specifying the proposed methods in Waste Discharge Requirements. In addition, at a site where the hydrogeology is not sufficiently well characterized, statistical data may lead to false conclusions. **[41S]**

Response: The regulations were not changed in response to this comment because the use of statistical methods is essential to an effective monitoring program. Statistical training for regional board staff is presently being arranged. In the mean time, any shortfall in statistical knowledge will have to be made up through either the use of outside statistical consultants or through the hiring of individuals trained in statistical inference. In regard to the problems arising from the application of statistics at sites where the hydrogeology is poorly understood, the commentor provides the best of all reasons for requiring an adequate [i.e., thorough] site characterization. Under Section 2595 the regional board must require an adequate hydrogeologic site characterization to be submitted by the discharger. If the discharger refuses to submit appropriate statistical proposals, the regional board has adequate enforcement authority to achieve the desired end [e.g., fines, cease and desist orders, etc.]. In any case, it is the responsibility of the regional board to verify that the site characterization is adequate prior to granting permission for the discharger to begin [or continue] discharging to the unit.

Subsection 2550.7(e)(8)

There are typically dozens of specific statistical methods within each of the general categories of statistical method listed in the revised regulations. If one certain category of statistical test is indicated by the data distribution, then within that category there will be specific statistical tests that will work

well and other tests which are unsuitable. Both the choice of the statistical method proposed on the part of the discharger and the subsequent analysis of that proposal by the Regional Board should be carried out by an individual especially trained in statistical theory and application because there are many more inappropriate statistical tests for a given constituent than there are appropriate tests and an inappropriate statistical method gives no basis of assurance that the method will provide valid indications of a release.

Just as a person afflicted with myopia is better served by prescription glasses than by drug store "reading glasses", so too is the discharger's monitoring data better analyzed by a prescribed suite of statistical methods rather than by methods that have not been tailored to the specific characteristics of the data and the hydrogeologic conditions at the waste management unit. These subsections are included in the revised regulations for purposes of consistency with the federal regulations [40 CFR 264.97(h)]. In addition, they are necessary for providing the discharger with a listing of the classes of statistical methodology within which the discharger will find a specific method appropriate for analyzing the monitoring data from the waste management unit.

Comments On Subsection 2550.7(e)(8):

Comment: The types of statistical tests allowed in Subsections 2550.7(e)(8)(A-E) should be adjusted to be equally powerful at detecting contaminants. **[67D {VII.C.67., pages: 7,23-24}]**

Response: The regulations were not changed in response to this comment for the following reasons. The statistical performance standards of Subsection 2550.7(e)(9) require, among other things, that the discharger demonstrate that the method proposed is the most likely to detect a release (i.e., the most powerful). The conditions at the site determine, to a great extent, which statistical method would be the most powerful. In general, the less powerful methods (under a given set of site-specific conditions) can have their power augmented by increasing the sample size (the number of data points analyzed), but there is little point in this because the best method will have the most power with the least number of samples. That is the one that should be used.

Dr. Neil Willits, State Board statistical consultant, had the following to say in response to this comment.

> "Comparability among tests is a laudable ambition, but it's also important to implement tests in a way that small facilities face similar hurdles (in terms of experimentwise Type I error) as do large, complicated facilities. This is one of the goals of the language describing the multiple independent retests **[ED: now called "discrete" retests]**; decisions among statistical methods should be made based on their properties (i.e., their power), and it's difficult at best to compare methods that have grossly differing Type I error rates, given that you have an unequal frame of reference."

Comment: Two commentors submitted a proposal at the June 6, 1990, State Board Workshop requesting substantial changes to the sampling and statistical analysis provisions of the revised article. The commentors first characterized the revised article's methodology as follows.

State Water Board Proposal Synopsis:

1. Take a minimum of 4 samples semi-annually [i.e., 8 samples per year].

2. Compute a statistic that will compare the upgradient background database with either the mean of the 4 semi-annual samples [i.e., ANOVA or prediction limit] or each of the four individual samples [control chart of tolerance limit]. Although it is not clear from the description, a prediction limit for each individual measurement is probably also consistent with this regulation.

3. The statistical evaluation in (2) should be performed on a semi-annual basis.

4. The Type I error rate [i.e., the percentage of false-positive indication] for the site as a whole cannot be less than 5% and the Type I error rate for any individual well comparison cannot be less than 1%.

5. If ground-water moves so slowly that 8 independent samples are not available, the owner/operator must still collect and analyze these samples [commentor

characterizes this as "...a clear violation of the assumptions of the statistical model"].

6. In the event that an initial sample [or mean of 4 samples] fails the statistical test, do the following:

   * If the probability is less than .05/w [where w is the number of monitoring points], then the procedure has confirmed a release.

   * If the probability is less than .05 but greater than .05/w, then collect at least 4 new samples if you are using ANOVA or prediction limits for the mean of 4 samples or collect 1 new sample if you are using tolerance limit, control chart, or prediction limit for the next single measurement of each of w monitoring points [only the monitoring points that failed the original statistical test are resampled].

   * Compute the average of the initial sample(s) and the resample(s) and compare the new mean value to the upgradient background using the same statistical method. If the resulting probability level is less than 5%, a statistically significant indication of a release is confirmed.

The commentors synopsized the proposed alternative procedure as follows.

"In contrast, GSX proposes the following:

1. "Take 4 quarterly samples per year, as is current the practice.

2. "Compute a statistic that compares the upgradient background database with a single new quarterly measurement at each of w point of compliance (POC) wells (i.e., prediction limit, tolerance limit, or control chart). Non-parametric prediction limits (see Gibbons, 1990) can also be used when a sufficient background sample size is available to provide 95% confidence.

3. "The statistical analysis described in (2) should be performed on a quarterly rather than a semi-annual basis.

4. "The Type I error rate for any individual well point comparison cannot be less than 1% for the initial sample.

5. "Quarterly sampling is the minimum sampling frequency, and must be justified on the basis of hydrogeological considerations.

6. "In the event of a significant statistical result, do the following:

   * "Take two new weekly samples (i.e., two samples one week apart). This is a modification of our previous proposed based on my May 18, 1990, meeting with Dr. Willits. See his letter to Tony Hashemian at DHS regarding May 18, 1990, meeting, which indicates that this is a reasonable alternative to his proposed method and will not result in exceptionally high false-positive rates which he acknowledges his proposed method will indeed produce.

   * "If both samples are below the original prediction, tolerance, or control chart limit, return to normal detection monitoring.

   * "If either one of the two new samples exceeds the original limit, a statistically significant result is confirmed.

"In certain cases, it is reasonable to extend the number of resamples to three instead of two."

The commentors claim that this method is just as protective of water quality as is the State Board's proposed method, but uses half the number of samples, provides improved detection in some instances, and greatly decreases the rate at which releases are falsely indicated. **[54A,56A]**

Response: In response the portion of this comment requesting a minimum quarterly statistical analysis frequency, statistical tests requiring a single sample per run are now required to conduct the statistical analysis as soon as the laboratory has analyzed the sample and returned the result [see revised Subsection 2550.8(f)(4)]. However, the semi-annual statistical test frequency was left unaltered for statistical tests requiring four or more samples per analysis.

The regulations were changed in response to the portion of this comment that requests the use of a verification procedure featuring at least two independent retests **[ED: now called "discrete" retests]**, each of which must invalidate the original indication of a release if the discharger is to avoid being moved to an Evaluation Monitoring Program. This change was made because State Board staff agrees with the commentor that this portion of the commentor's proposal provides a considerable decrease in the frequency of occurrence of falsely-indicated releases while at the same time having a negligible effect upon the power of the method to indicate the presence of a real release.

Comment: Subsequent to the June 6, 1990 State Board Workshop, Dr. Gibbons [the commentors' statistical consultant] has spoken with Dr. Willits of U.C. Davis [the State Board's statistical consultant] and has confirmed that Dr. Willits concurs that this approach [see Comments 54A and 56A, above] should be acceptable to the State Board. Further, it is our belief that such an approach would be in conformance with existing RCRA regulations and thereby should not jeopardize California's RCRA authorization efforts with the USEPA. **[56C]**

Response: The regulations were not changed in response to this comment because the comment does not request a change. However, in response to the statements made, Dr. Willits has expressed partial agreement with the referenced proposal but has voiced a number of reservations. The State Board regulations have been changed, as described in the response to Comment 56A, to include all portions of the proposal that Dr. Willits has indicated are beneficial in helping to indicate the presence of a release; however, those portions of the proposal that decrease the power of the statistical method are not included. It is not possible at this time to discern what reaction the USEPA will have relative to the altered statistical retest procedure included in the revised article. However, it is the position of State Board staff that any statistical approach which reasonably maintains the power of the statistical test to detect a release while at the same time decreasing the likelihood of false indications should not be subject to adverse comment from the USEPA. It is for this reason that State Board staff is including only those portions of the proposal that benefit the overall performance of the statistics.

Comment: The regulations should be changed to allow alternative statistical analysis to be performed on a quarterly basis. **[56B]**

Response: The regulations have been changed in accordance with this comment.

Comment: Several commentors requested a statistical methods workshop to acquaint both the Regional Board staff and the regulated community with the new statistical methods. **[12E,16C,22A]**

Response: This comment does not require a change in the regulations; however, the State Board is planning to provide introductory training to the Regional Board staff on this matter and will consider suggestions as to how such training may be held jointly with the regulated community.

Comment: One commentor expressed concern that the regional board does not have adequate resources to evaluate the statistical proposals submitted by dischargers. **[41T]**

Response: The regulations were not changed in response to this comment for the same reasons as expressed in answer to comments 37T and 41S in the portion of this SOR addressing Subsection (e)(7) of this section.

Parametric ANOVA [Subsection (e)(8)(A)]

Parametric analysis of variance [parametric ANOVA] is expected to be one of the principle methods used to analyze monitoring data because this method requires less background data than the control chart or prediction interval methods. In addition, it has the additional advantage of spreading the risk of a Type I error [false-positive] over all the downgradient monitoring points. [Note: for a more in-depth treatment of the Type I error, refer to the discussion of Subsection (e)(9)(B).] It is also one of the most powerful classes of statistical procedures available and requires fewer samples to be taken for proper performance than is typically required by the non-parametric methods. The parametric ANOVA is first used to compare the data from all downgradient and upgradient monitoring points. Following this, individual comparisons are made between each downgradient monitoring point and the background monitoring points. A statistically significant increase over the background

data during any one of these comparisons constitutes statistically significant evidence of a release from the unit.

The parametric ANOVA can only analyze numerical data, therefore, if some non-numeric data ["non-detect" and "trace" readings] exists within the data, it must either be assigned numerical values prior to analysis or a nonparametric method must be used. The specific method in which such non-numeric data are assigned numerical values is a matter for determination by a competent statistician, however, reliable methods do exist for achieving this goal. The parametric ANOVA assumes that the data distribution does not differ from the normal distribution relative to kurtosis and skewness and that the variance of the upgradient data is approximately the same as that of the downgradient data. In cases where these assumptions cannot be satisfied, the data can usually be transformed so that it does so.

All ANOVA methods share a weakness: the assumption that all downgradient data has come from the same population. This assumption is violated if a contamination plume arrives after one or more of the downgradient samples for that monitoring point have been taken -- some of the samples are pre-plume and the rest contain elevated concentrations of monitored constituents. This mixture of downgradient samples tends to cause the ANOVA to have a Type II error (say there is no release). The next sampling episode will likely have all samples showing some degree of contamination, resulting in a strong statistical indication, but this does not make up the method's having failed to indicate the initial arrival of the release. In order to avoid missing the release when it first arrives, it is best to schedule the 4-or-more samples such that they are all taken over a relatively short time-span. Obviously, it is a bad idea to spread the four samples evenly over the six-month period (one sample every six weeks) as this invites missing the initial arrival of a plume. If the long hiatus between suites of samples is inappropriate for a given site, then the solution is to go to quarterly statistics, collecting the four samples at the beginning of each quarter so that the laboratory results for each quarter will be ready by the end of that quarter.

Non-Parametric ANOVA [Subsection (e)(8)(B)]

The non-parametric analysis of variance method [non-parametric ANOVA] has many of the advantages of the parametric ANOVA discussed above, however, its primary use is with data sets containing primarily non-numeric data. In such cases, it is nearly as powerful as a parametric ANOVA is with numeric data.

One disadvantage of the non-parametric ANOVA is that it cannot be used with as small a number of samples as can the parametric ANOVA. In spite of this, the non-parametric ANOVA is a necessary alternative because it represents one of the only methods capable of addressing constituents whose background and downgradient concentrations typically fall below the practical quantitation limit. The type of data and the way that data is distributed dictate both the general class of test that is most appropriate and the specific statistical method within that class that will provide the best overall performance.

Tolerance or Prediction Interval [Subsection (e)(8)(C)]
The tolerance interval and prediction interval methods are closely related, so are treated herein as a single general class of statistical method. This method requires considerable background data; however, it has the advantage of requiring as little as a single sample per determination. In addition, the analysis is rapidly and easily carried out. The statistician determines a downgradient sample concentration above which a release would be indicated. Once that value is established, statistical analysis can be carried out by simply comparing a downgradient sample concentration with the established maximum value. If the sample's concentration exceeds this value, then a release is indicated. In addition to providing a simple method of statistical comparison for the discharger, this method is also of advantage to the Regional Board because the statistical test can be required after each sample is taken rather than having to await the collection and laboratory analysis of an entire suite of samples, as required by some other methods. A release can, therefore, be indicated sooner than with multi-sample techniques and the problems associated with mixed samples is avoided [see foregoing discussion at the end of the portion of this SOR addressing the parametric ANOVA method]. This method cannot tolerate truncated or skewed distributions, however data having these problems can often be made suitable for this method through transformation.

Control Chart [Subsection (e)(8)(D)]
The control chart method has the advantage of being able to totally eliminate effects of spatial variation, in that it uses an intra-well comparison in which the well's current samples are compared against background data from that same well which background data has been shown to have no indication of contamination. Under this method, the statistician first analyzes the historic data from the [downgradient] monitoring point to be sure that there is no contamination indicated in the background data suite. Once validated, this data is plotted

through time. The statistician provides one line on the chart indicating the mean concentration of the constituent, and a second line indicating the maximum concentration expected by any future sample from that monitoring point. The concentrations of future samples are then tested against the historic concentration trend indicated on the chart. If a sample's concentration plots higher than the expected maximum concentration for that constituent at that well, then a release is indicated. In addition, the method can trigger on the basis of having an unnusual number of high concentrations in a row [the cumumlative sum approach used in the Shewhart CUSUM method], even though no single concentration exceeds the critical value. This method is necessary for providing a rapid, easily implemented statistical analysis in cases where intra-well comparisons are valid.

Tests Other Than The Above [Subsection (e)(8)(E)]
All statistical test methods are subject to review by the Regional Board. This subsection permits statistical methodology other than the above-listed methods to be submitted because the State Board does not want to preclude the discharger from using alternative methods if those methods can satisfy the statistical performance standards. However, the discharger must demonstrate that all proposed methods, including alternative methods proposed pursuant to this subsection, satisfy the statistical performance standards under this section because the Regional Board must be able to rely on these methods for purposes of compliance verification and enforcement.

One of the options available under this "any other method" mode is one which uses a retest to control the incidence of Type I errors [false indications of a release]. It is very necessary in any retest that the method used not cause the Type II error rate [i.e., missed releases] to increase to any great extent. Therefore, this subsection contains specific performance standards that apply to retest procedures and which are additional to the performance standards of Subsection (e)(9) of this section.

It is beneficial for both the regional board and for the discharger that false indications of a release not cause time-intensive investigations. Therefore, the use of a retest can be of benefit to all concerned. On the other hand, this resampling and reanalysis should not be allowed to cause excessive delays in instances where an actual release has occurred; therefore, Subsections (e)(8)(E)1. through (e)(8)(E)7. contain specific requirements designed to permit an expedited-but-accurate check of the initial indication of a release. There are two general

types of retest, as described in the regulations: a "composite" retest, which involves adding new data to the data which gave an indication of a release; and "discrete" retests, which involve at least two separate episodes of sampling and testing, using only new data. The two approaches require slightly different requirements to operate properly.

Subsection (e)(8)(E)1., which applies only to discrete retests, is needed to clarify the fact that the only way the original indication of a release can be rejected is if **each** of the several discrete retests shows no indication of a release.

Subsection (e)(8)(E)4. clarifies the data that is to be used in the two types of retest. The "discrete" retest entails collecting at least two sets of new data from the indicating monitoring point and then running the statistical test separately on these two new sets of data. The other type of retest ["composite"] makes use of the original data but increases the sample size by taking enough new samples to at least double the original sample size. This augmented suite of data is then analyzed. Because the original data is retained, only a single retest is necessary. The large size of the combined data set will tend to counter the effects of any high concentrations in the original data set.

All retest methods adopted for use pursuant to Subsection (e)(8)(E) will feature individual monitoring point comparisons because only those individual monitoring points that indicate a release will be re-sampled and analyzed. Normally a Type I error level of 0.01 over six months is permitted for individual monitoring point comparisons, however, Subsection (e)(8)(E)5.a. requires a 0.05 comparison-wise Type I error level for composite retests. The use of this higher minimum Type I error level is necessary with the composite retest to control the Type II error rate [missed releases] and is reasonable because this analysis is being applied under conditions where a release has been already indicated.

By contrast, Subsection (e)(8)(E)5.b. features a formula-driven approach to Type I error control where discrete retests are used. The formulas determine the comparison-wise error rate to be used with the original test and with the two or more discrete retests. These formulas adapt the error rate to the individual site conditions and monitoring system so that the overall six-monthly error rate can be maintained at the desired level regardless of site-to-site variations in the number of monitoring points, the number of monitoring parameters, or the sampling frequency. The

approach in subsection b. permits a very low Type I error rate while affecting the Type II error rate only slightly.

In order to keep the Regional Board apprised of the investigation, Subsection (e)(8)(E)6. requires the discharger to report the results of the statistical retest as well as the concentrations of each parameter involved in retesting within seven days of the last analysis.

Subsection 7. is necessary to clarify that the intent of the regulations is that a retest is only required at those monitoring points which have indicated a release.

Comments On Subsection 2550.7(e)(8)(E):

Comment: In order to maximize the protection to human health and the environment, the statistical method chosen should be the one that will provide the greatest statistical "power" to detect a release and should be based upon the assumption that the variation in the data primarily reflects the variation of the actual concentration of a contaminant in the water rather than variation in measurement error. One problem with the retest methodology in the regulations is that it only provides a retest when an initial statistical test indicates that a release is likely to have occurred. This approach is not protective of water quality because it is likely that in the case of a real release some samples from a contaminated well will be below the concentration limit. Such samples will falsely indicate that there is no release (Type II error); this should be precluded by applying a retest to statistical tests which come close to indicating a release. This retesting would inhibit the likelihood of missing a release that failed to be indicated initially merely because of a lack of data or because of variation in the pollution level.

For example, consider the discrete retest approach. Presently, the two discrete retests are required only if the initial sample indicates a release. If a sample labeled "L" has a large enough concentration of a contaminant to trigger an indication of a release and a sample labeled "S" has too small a concentration to trigger, then the current language of the regulation would evaluate an LSS series (original plus to discrete retests) as indicating no pollution. However, if the first test used an S sample that barely missed triggering, then the herein-proposed retest method would cause Evaluation Monitoring if the retest series came out either SLS or SSL. Note that either of these

series of tests has the same amount of information as did the LSS series which resulted in not going to Evaluation Monitoring. The present regulations, therefore, exhibit a lack of balance between Type I and Type II errors because a sample that barely misses triggering a rejection of the null hypothesis is not investigated as carefully as one that causes a rejection of the null. This results in small-concentration releases failing to trigger Evaluation Monitoring because no retesting is done if the first sample falsely fails to reject the null hypothesis.

A corollary to this is that if you don't want **any** tap water to exceed a certain health-based standard, then the concentration limit must be set at a concentration that is well below the health-based standard in order to account for variability in the concentration of the constituent. **[67X {pages: 59-68,69}]**

Response: The regulations were not changed in response to this comment for the following reasons.

According to Dr. Neil Willits, the Board's statistical consultant, the statistical methods in the proposed regulations that feature retesting are fully capable of detecting a release, yet are at the same time very unlikely to indicate a release when none exists. Therefore, the existing proposed regulations strike a reasonable balance between environmental protection and unnecessary loss of time and money from responding to falsely indicated releases.

The commentor's suggestion provides no basis for establishing how close to the population mean the sample must be before it no longer must do a retest [given a non-significant initial indication]. In cases where there is some fluctuation in constituent concentration, such as at the very leading edge of a release plume, there is a very strong likelihood that the release that is initially detected will be verified by the retest(s) because the retest(s) are rapidly carried out after the initial indication. Under the extremely rare circumstance where the original indication was falsely invalidated, the discovery (and verification) of the release is almost a virtual certainty during the next sampling episode. This approach provides adequate time to respond to a release, considering the delays inherent in delineating the nature and extent of a release and in establishing effective corrective action measures.

Each concentration limit greater than background [CLGB] considers any applicable health based standards but is set at the lowest concentration that is technically and economically achievable.

In addition, CLGBs are allowed only as cleanup standards (the USEPA regulations allow such elevated limits without necessarily requiring corrective action).

Dr. Willits' response to this comment is as follows.

> "One of the implications of the dependent retest is that for a fixed experimentwise Type I error level, the significance level used for the initial test will be greater than for a method that doesn't include a retest. (This comment was explained with greater elaboration in my response to comment 67B **[ED: part of the SOR for this subsection]**.) The upshot of this is that their desire to trigger retesting for somewhat smaller initial indications is exactly what's being done."
>
> "...They mentioned the role of spatial variability in the samples that are collected. The notion was that if the concentration limit is set on the basis of health protection, then the mean concentration could be below the limit, and yet individual samples (of drinking water, for example) could still be above the limit. The reason that this comment doesn't hold water (no pun intended) is that in detection monitoring, the limit against which measurements are tested is the background (up-gradient) level, which is presumably far below any level that might be hazardous. Thus, when measurements are taken that are indicative of a release, they should still fall below the level at which hazard would occur."

Comment: The Bonferroni adjustment shown in Subsection 2550.7(e)(8)(E)1. of the September 7, 1990 version of this article would be more protective if it were applied to "discrete" retests as well as to "composite" retests. In this way a very large value cannot be bypassed by a retest procedure. **[67V (pages: 56)]**

Response: The regulations were not changed in response to this comment for the following reasons. The provision using the Bonferroni adjustment has been eliminated because it was noted that it tended to make retesting very unlikely except in cases where the null hypothesis was rejected only marginally. Because the retest procedure is not likely to miss a real release, it is unreasonable to apply restrictions to the use of the retest.

Dr. Neil Willits, State Board statistical consultant, had the following to say in response to this comment.

> "One of the desirable properties of the retesting procedures is that if undocumentable quality control problems exist, this won't necessarily force a facility immediately into corrective action. The primary intent of the Bonferroni adjustment language was originally to avoid unnecessary delays in implementing corrective action, rather than to maintain the test's sensitivity. The current thought is that the avoidance of spurious corrective action due to undocumentable quality control problems is more important than the slight delay that would be caused by retesting the well or wells in question."

Comment: The purpose of the equations in Subsection (e)(8)(E)5.b. is not clear and should be stated in words in the regulations so that an environmentally-protective application can be made in cases where the formula is inappropriate. **[67F {page 8}]**

Response: The regulations were not changed in response to this comment for the following reasons. It is not appropriate to state the purpose of each provision of the regulations within the regulations themselves. That is the function of the Statement of Reasons [SOR], as provided by the Administrative Procedures Act [Subsection 11346.7(a)(2) of Article 5 of Chapter 3.5 of the government code]. The purpose of these formulas is adequately and clearly described in this SOR.

Dr. Neil Willits, State Board statistical consultant, had the following to say in response to this comment.

> "If these people have all of my memos written to Health Services and / or the Water Board, then they ought to understand the intent of the formulas well enough. If they have further questions, then I would welcome any personal inquiries they might care to address to me."

Comment: The modification to Subsection 2550.7(e)(8)(E)1. removes the requirement that if the first test value is significantly large, then it must be kept as part of the test samples. This change increases the probability of a false negative. **[67E {VII.C.67., page 7}]**

Response: The regulations were not changed in response to this comment because the comment misinterprets the deleted language. The deleted language precluded doing a composite retest (previously called a dependent retest) at all unless the original indication of the release was marginal. By deleting this language, a retest can be carried out regardless of the strength of the original indication. This is appropriate because the retest has such a small chance of enabling a real release to be ignored yet such a high power to eliminate false indications of a release. This combination provides such a high practical value that there is little use in restricting the application of a retest. After all, the purpose of the retest is to provide a closer look by increasing the sample size. Such an approach is always appropriate because retesting takes little time, yet disallowing a retest automatically causes a waste of money and person-days as both the discharger and the regional board attempt to respond to fictitious indications of a release. Frequent false-positive indications must be avoided not only because of their cost but also because they lower the credibility of the results, fostering a less-than-vigorous response in the event a real release is discovered.

Dr. Neil Willits, State Board statistical consultant, had the following to say in response to this comment.

> "One of the desirable properties of the retesting procedures is that if undocumentable quality control problems exist, this won't necessarily force a facility immediately into corrective action. The primary intent of the Bonferroni adjustment language was originally to avoid unnecessary delays in implementing corrective action, rather than to maintain the test's sensitivity. The current thought is that the avoidance of spurious corrective action due to undocumentable quality control problems is more important than the slight delay that would be caused by retesting the well or wells in question."

Comment: Subsection 2550.7(e)(8)(E) contains a number of disturbing provisions. For one, it permits the discharger to submit virtually any statistical method; affected parties [e.g., water purveyors] would then have to enter into a detailed battle about all the elements of the proposed test.

Secondly, it allows retests of valid indications of a release. It is inappropriate to permit a retest procedure that ignores

data that originally indicated the presence of a release; in fact, no retest method should be allowed that will increase the Type II error rate (i.e., increase the likelihood of missing a real release). The discrete retest method is like permitting the discharger to simply throw out high-concentration values unless there are two hits in a row (or two out of three).

Both the discrete and the composite retests seem to be ignoring the situation in which a release occurs in slugs such that a contaminant could be present in elevated concentrations in one sample but not in the next; neither approach appears to address parameters which exhibit time dependence. The purpose of the retesting is to check on analytical reliability, not to make another evaluation of whether a release took place or not. The wording of this subsection focuses upon indications given by single constituents; therefore it inappropriately would allow routine retesting in cases where several monitoring parameters are indicating a release at the same time, even at the same well. **[67B {VII.C.67., pages: 1,6,7-8,24,29,53,55,58}]**

Response: The regulations were not changed in response to this comment for the following reasons. This subsection does not permit just any method to be used. Instead, it permits any method that can be demonstrated to pass the performance standards of Subsection 2550.7(e)(9) to be proposed. One of those performance standards [under Subsection (e)(9)(A)] is that the method must be the most likely to detect a release.

The discrete retest method does not "throw out" the original data. Rather, the original indication is used as a reason to look further at the concentration of the indicating parameter (or constituent) at that monitoring point. The expanded data collection of the retest provides an increase in sample size, and thereby increased statistical power, at the very time when such additional power is needed. By using a larger sample size only when a release is indicated, instead of all the time, the power of the statistical method remains high but the cost of sample collection and analysis is kept within reason.

Only actual releases should be investigated, yet without an effective retest provision the 1% Type I comparison-wise error rate means that false alarms will be a common experience. Although there is a very small increase in the Type II error rate, when using a retest procedure, this is more than balanced by the large decrease in the Type I error rate. In this way, a retest procedure assures that the statistical results will be taken seriously because in the vast majority of cases a retest

which validates the original indication of a release is correct in doing so. By contrast, in the absence of a retest, the most common indications of a release would be false-positive indications -- a condition which, by frequently "crying wolf", would decrease the speed of response to a real release. In addition, the use of retests, including discrete retests, is valid because valuable and limited resources of the discharger, the regional board and the state board are consumed each time a Type I error triggers a needless evaluation.

The purpose of the retest is **not** to check on analytical reliability; rather, its inclusion in the regulations is in recognition that the regulations require statistical method to have such a "hair trigger" that even samples from background (if used in place of downgradient samples to demonstrate this point) would frequently indicate that a release has occurred. The prompt instigation and completion of the retesting, as required in the regulations, precludes having a release "disappear" during the retesting by having been wafted away by seasonal fluctuations in flow direction or concentration intensity.

Just because the article is designed to trigger Evaluation Monitoring on the basis of one parameter's exceedence at one monitoring point does not mean that multiple indications are ignored. Multiple indications of a release only further the likelihood that Evaluation Monitoring and Corrective Action will be implemented. In addition, there is nothing in the proposed article precluding the regional board from invoking the provisions of Subsection 2510(d)(2) of Article 1 of this chapter by requiring the discharger to investigate the likelihood of a release in cases where one or more monitoring points have triggered retests for several monitoring parameters. In addition, the commentor appears to be ignoring the other triggering mechanisms based either upon graphical evidence of monitoring data, pursuant to Subsection 2550.7(e)(14), or upon physical evidence other than monitoring data, pursuant to Subsection ,2550.1(a)(3). The goal of this article is to provide effective protection of human health and the environment while at the same time avoiding false alarms.

Dr. Neil Willits, State Board statistical consultant, had the following to say in response to this comment:

> "It's true that the use of a dependent or an independent retest will allow a seemingly valid indication of a release to be overridden if subsequent data that's collected fail to confirm that indication. One rationalization for this is

that however complete a quality control program may be in effect, the possibility of spurious measurements can't be excluded altogether. Rather than requiring corrective action for any such imaginary releases, the retest allows them to be verified prior to corrective action. Second, it should be noted that for small facilities (i.e., ones in which the Type I errors resulting from multiple comparisons aren't an overwhelming problem), the level at which the initial tests are conducted can be greater than the .05/.01 rates that are customarily used without a retest. For example, if a monitoring network contains only one down-gradient well and constituent, then semi-annual data evaluations would be conducted at the α = .158 level, and if a prediction interval was used, based on 8 samples per year, the α-level used would be .080. Thus, the use of a retest allows more marginal indications of a release to be investigated further.

"The second benefit provided by the retest is that an unreasonably high Type I error rate can be avoided. One consequence of requiring individual comparisons to have a .01 comparison-wise error rate is that for a large facility, false positive indications are bound to occur frequently, even if the down-gradient data have exactly the same statistical distribution as the up-gradient data. These false alarms would be costly and could only distract attention from any true releases that might occur."

Comment: This subsection should require methods for control or correction of seasonal and spatial variability, and temporal correlations. In addition, any practical quantitation limit [PQL] used in determining statistically significant increases over background should be the lowest concentration level that can be reliably achieved given limits of laboratory precision and typical operating conditions. **[59H]**

Response: The regulations were not changed in response to this comment because the requested additional requirements already apply to retests conducted pursuant to this subsection. As indicated by the wording of the first paragraph of this subsection, the requirements of this subsection are "...in addition to the statistical performance standards under Subsection (e)(9) of this section"; therefore, the PQL requirements of Subsection (e)(9)(E) apply to retests, as do the requirements of Subsection (e)(9)(F) [i.e., to consider seasonal, spacial, and temporal variability].

Comment: Revised Subsection 2550.7(e)(8)(E)4. requires combining data from confirmational sampling with initial data. The confirmation sampling is conducted to help identify errors in the initial data. If there is error in the original data, it should be **discarded** rather than combined with subsequent data.**[37D]** The data from the original sampling event should not be combined with the data from the verification sampling event. Please explain the statement "...all data obtained from the initial sampling event combined with all data obtained during this resampling".**[45B]** This subsection should be modified to allow outliers and erroneous data resulting from analytical errors [such as a laboratory QA/QC error] to be excluded from data used to perform the statistical test. Including outliers or erroneous results will incorrectly bias the data.**[48K]**

Response: The regulations were not changed in response to this comment for the following reasons. Data which indicates high concentrations erroneously is handled either under Subsection 2550.8(k)(7) or via an approved Quality Assurance/Quality Control plan. Anomalously high values which cannot be shown to be in error should **not** be thrown out because they may be indicative of a release. The purpose of the resampling and reanalysis is to increase the power of the statistical procedure by increasing the sample size.

For a composite retest procedure, if three of the four original samples used in an ANOVA, for example, exhibit high concentration values when combined and reanalyzed with other sample data that contains no high values, the retest will typically not indicate that a release has occurred. However, if two or more of the samples taken in the retest also show a high concentration, then the combined data set will indicate that a release is likely to have occurred. This is a sound, conservative, statistically-viable approach.

For an discrete retest procedure, if the single sample used for a prediction limit test, for example, exceeds its upper prediction limit, then the discharger will go to evaluation monitoring **unless** the discrete retests (two or more) all indicate that the original indication was in error. The likelihood of being forced to evaluation monitoring by chance alone is much less with this approach than with an composite retest, yet the likelihood of missing a release is low with either a composite or a discrete retest method; therefore, it is anticipated that most dischargers will propose to use the discrete retest method.

In those few instances in which a retest procedure causes the discharger to be moved into an Evaluation Monitoring Program in error, the subsequent plume delineation effort will provide the discharger with adequate proof to demonstrate this to the regional board pursuant to Subsection 2550.9(f). Data should **never** be thrown out simply because it has a high concentration value; however, data which can be **proven** to be in error should be thrown out before being used in any statistical analysis and the action documented.

Comment: EPA's Region IX [Region IX] office commented that the retest procedures will greatly decrease the number of false indications of a release, but might also produce a slightly increased incidence of missed releases as compared to the USEPA approach stipulated under 40 CFR 264.98(g). **[27A64]**

Response: The regulations were not changed in response to this comment for the following reasons. Under revised Article 5, the discharger leaving detection monitoring in response to an indicated release is on the way to corrective action by way of an intermediate program, evaluation monitoring, which is used only to evaluate the nature and extent of the release and to plan effective corrective action measures. Under the USEPA approach, a discharger leaving detection monitoring will not instigate a corrective action program to clean up the release unless the presence of the release is validated by exceeding the RCRA Ground Water Protection Standard. This second statistical analysis, which the EPA carries out under their second program [called Compliance Monitoring], is analogous to the retest which is permitted under revised Article 5. By permitting a retest in detection monitoring [directly after a release is indicated], revised Article 5 filters out most false indications of a release without permitting units with a real release to escape entering corrective action.

Not only is validation of the release obtained much more quickly under proposed Article 5 than under RCRA, but the optional retest constitutes an essential precautionary step in a regulatory system which funnels the discharger directly toward corrective action. For both the Regional Boards and the dischargers there exists a limited amount of funding with which to address releases. If the retest procedure were removed from proposed Article 5 then the funds of both the Regional Boards and the discharger would be spent to a much greater extent upon the analysis of fictitious releases, thereby decreasing the effectiveness and timeliness with which real release could be

addressed. In addition, the high incidence of false-positive indications is a form of "crying wolf", such that when a real release occurs it is unlikely that the indication will be taken seriously. Such a move would result in an overall decrease in the environmental protection afforded by the regulations. Therefore, the retest provision is being retained.

The composite retest procedure in proposed Article 5 was worked out in principle between the State Board's statistical consultant, Dr. Neil Willits, and Joe Carra, an American Statistical Association member from EPA headquarters, for the express purpose of lowering the incidence of false-positive indications while having no significant increase upon the rate of missed releases. Dr. Willits drafted the language of the retest provision based upon this agreement. From both a practical perspective and from a statistical perspective, the retest provisions of proposed Article 5 satisfy statisticians of the State Board and EPA headquarters. EPA Region IX's critique of this provision, on the other hand, is apparently based upon a subjective analysis of the proposed regulatory language. In the absence of statistically supportable comments to the contrary, and in light of the fact that the EPA's regulations do not preclude the use of a retest, the State Board will retain the retest provision in the proposed regulations.

In order to provide a more technical support for the State Board's response to Region IX's comment, Dr. Willits' answer to the comment is included below, as excerpted from his September 25, 1989 letter to the State Board's Regulation Development Unit. The statistical power function graphs referred to by Dr. Willits in this letter are included as Figures 1A through 4B.

> "There are two types of error involved in any statistical hypothesis test. First, in the context of testing for a release of toxic waste, the test could fail to detect a release that's actually present. This is what's referred to as a Type II error. Secondly, a test could falsely claim that a release had occurred, when it in fact had not. This is called a Type I error. Both of these types of error have serious consequences. Failure to detect can cause a more serious release of a toxic substance than would otherwise have occurred. On the other hand, a falsely identified release diverts resources away from the treatment of genuine releases, and frequent false alarms may cause the reaction to a true release to be one of skepticism rather than action.

"For a given sample size, there's an unavoidable tradeoff between these two types of error. In the current guidance document, EPA recommends keeping the Type II error probability low by maintaining a high Type I error rate. The problem with this strategy is that it allows for unacceptably high Type I error rates, which have their own consequences. For example, if a site operator had 10 down-gradient wells, each of which was being monitored for 10 constituents, then (assuming the individual tests were independent), then the probability of a Type I error for at least one of the comparisons would be $1 - .99^{100} = .634$. Thus this operator would be faced with false alarms nearly two thirds of the time.

"This situation provides the operator with a strong disincentive from maintaining an adequate monitoring network, since the Type I error increases with the number of tests, which is proportional to the number of wells. The way around this problem would be to use a testing procedure that has a lower Type I error rate. While it would be desirable to do so without causing any increases in the Type II error rate, this is not possible, as can be explained by the following argument. The probability of detecting an actual release (one minus the probability of a Type II error) is called the <u>power</u> of the test. The power is an increasing function of the magnitude of the release, so that releases that are very large in magnitude can be detected by virtually any statistical test. Moreover, the power, viewed as a function of the magnitude of the release is continuous, so that for very small releases, the likelihood of detection will be only slightly greater than the probability of falsely detecting a release when none is present. This latter quantity is the probability of a Type I error, commonly called alpha. Thus, any decrease in the Type I error from alpha to alpha' would necessarily cause an increase in the Type II error for an infinitesimally small release from (1 - alpha) to (1 - alpha').

"Whether or not this increase is acceptable can be judged only by looking at the power function. The power function for such a test is prohibitively complicated to calculate directly, so it must be estimated with the help of a computer. The attached graphs [Figures 1A, 1B, 2A, 2B, 3A, 3B, 4A, and 4B] indicate the power (P) of such a retest method based on t-tests, for various sample sizes

for the initial and retest samples, and as a function of the magnitude of the release (MU), which actually represents the ratio between the magnitude of the release and the standard deviation of an individual observation. In all the graphs there are two curves plotted, the upper of which represents the power of the testing procedure **without a retest**, while the lower curve represents the power of the method that employs a retest. As can be seen [Figures 1A, 2A, 3A, and 4A], the curves virtually coincide, except for very small values of MU (i.e., very small releases). For that reason, I did separate plots that center in on the two curves for small values of both P and MU [Figures 1B, 2B, 3B, and 4B]. It can be seen that at its greatest, the difference between the two power curves is only about 1%. Whether this is acceptable is a subjective judgement, but it should be noted that the range of MU values for which there's much difference in the two curves is the range for which a release would be detected only through luck (that is, for which the power is very low to begin with). If the power of the test for such ranges of MU is a real concern, then the appropriate way to address this would be to increase the sample size.

"There are three ways in which this retest method serves to create a minimal increase in the Type II error. First, the data from the original monitoring is included in the retest. This means that no large observed pollution levels are forgiven in the course of the retest. (Incidentally, it also causes the original test and the retest to be correlated, which is what causes the power calculations to be unwieldy.) Secondly, while the original test could be run using alpha = .01, the retest is required to be run using alpha = .05. Had the retest been run using alpha = .01, the reduction in Type I error would have been more dramatic, but the Type II error would also have increased to a somewhat greater extent. Finally, the use of the Bonferroni pre-test before a retest is allowed means that the retest will be allowed only when the statistical evidence in favor of a release was weak, considering the number of comparisons involved. Thus, when the data present clear evidence of a release, then even though it's highly unlikely that a retest could reverse the original test, the retest wouldn't be allowed to proceed and any unnecessary delay would be avoided."

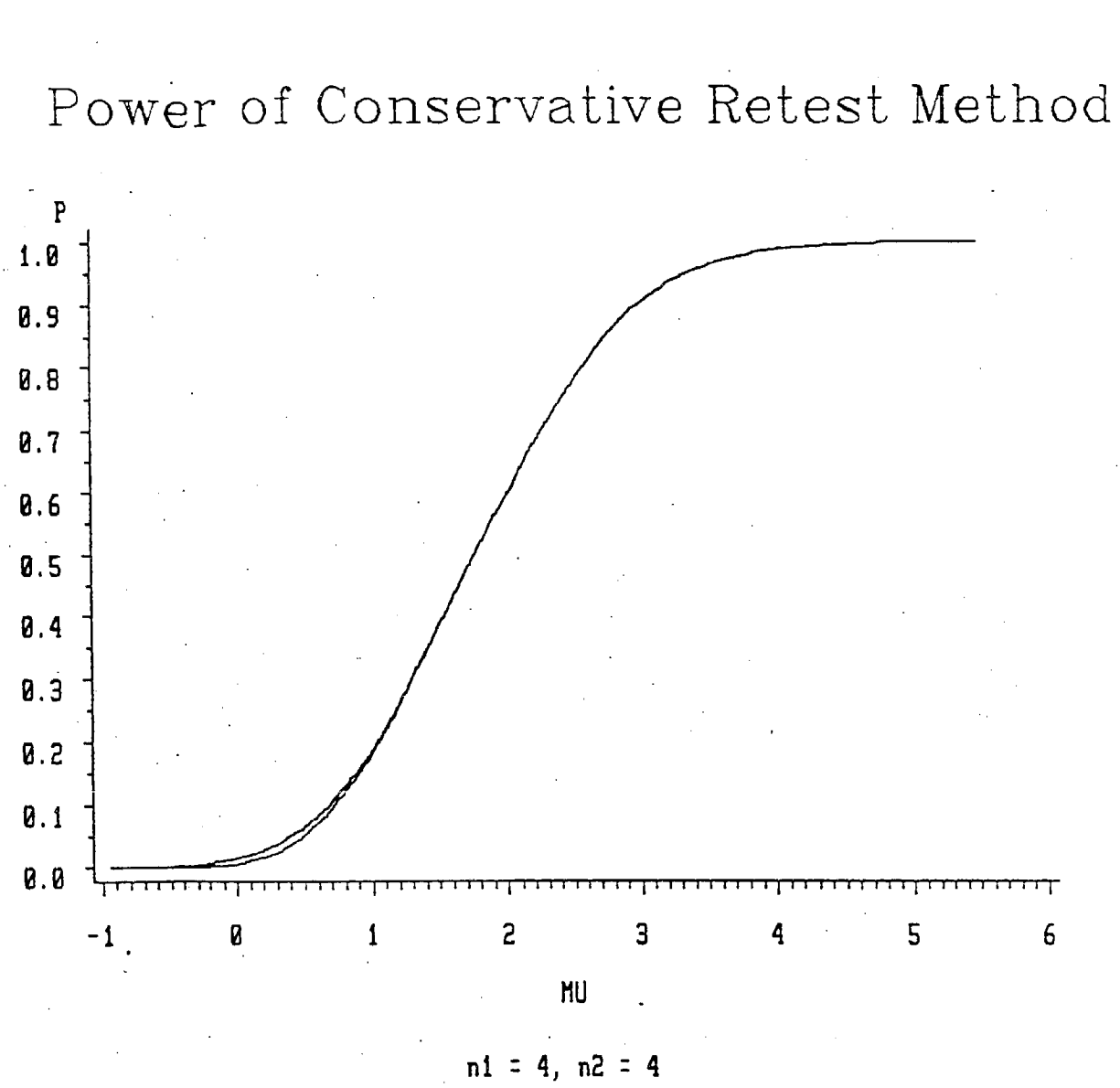
Power of Conservative Retest Method
P
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-1
0
1
2
3
4
5
6
MU
n1 = 4, n2 = 4

FIGURE 1A

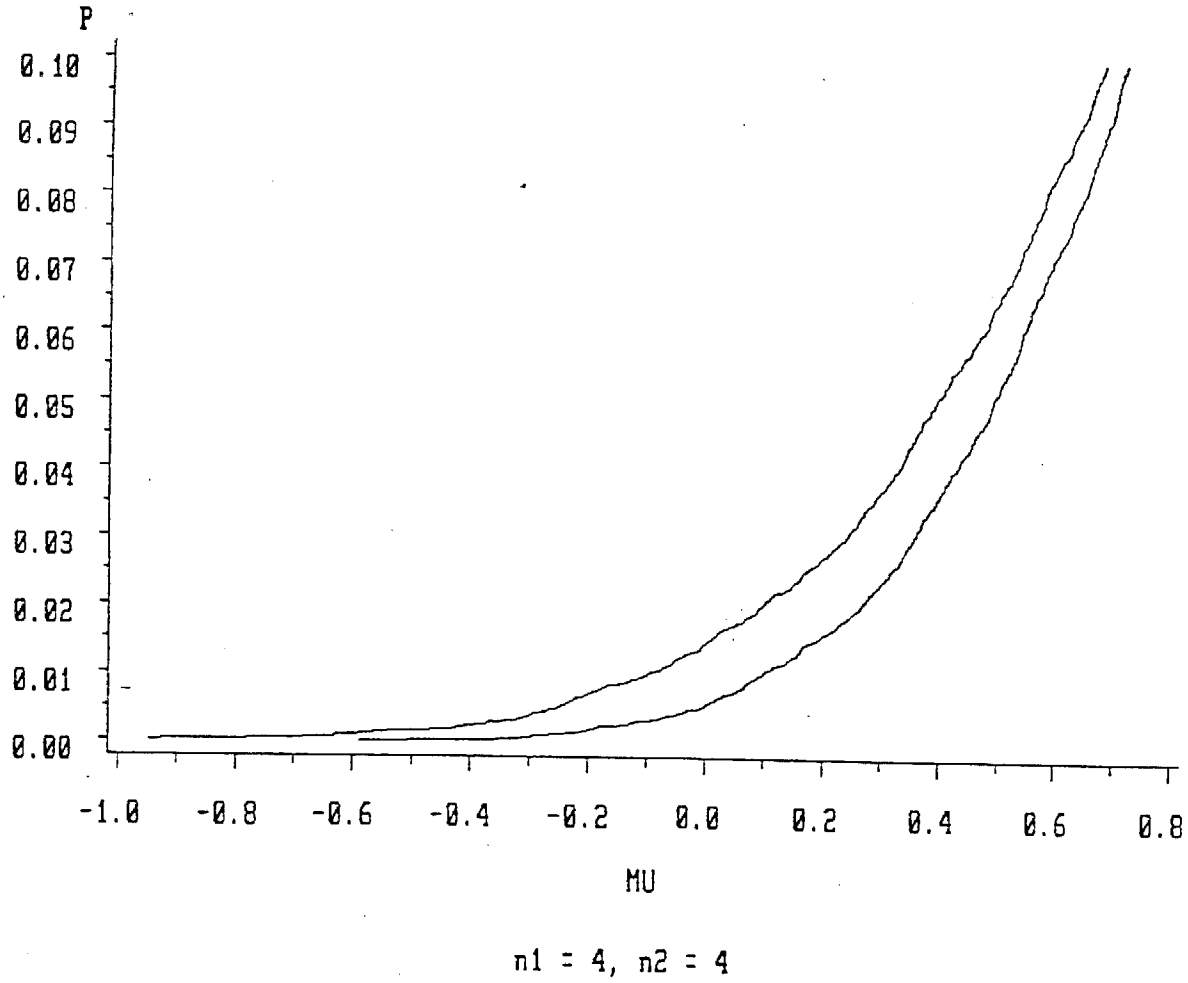
Conservative Retest Method for small p
P
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
0.4
0.6
0.8
MU
n1 = 4, n2 = 4

FIGURE 1B

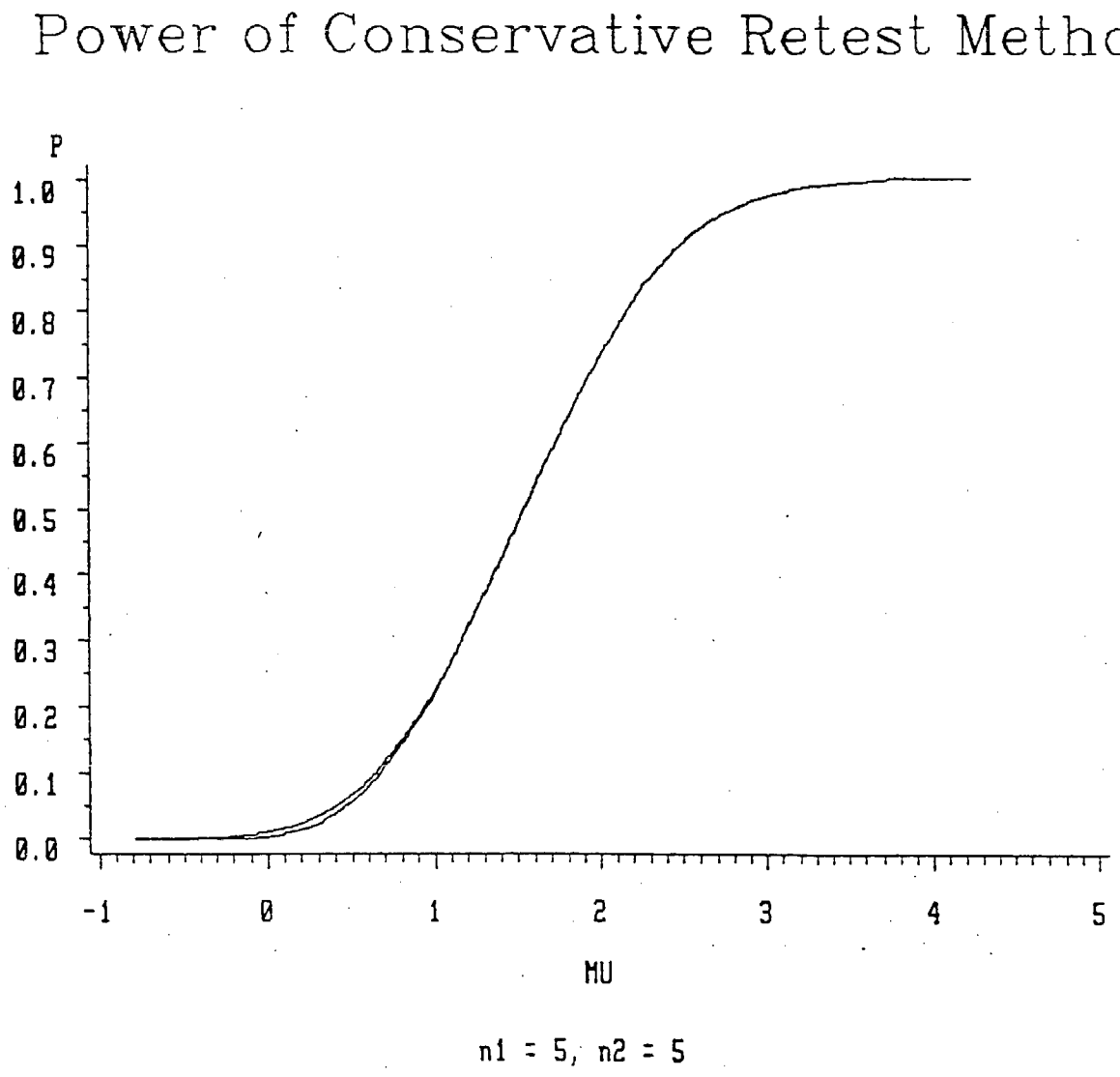
Power of Conservative Retest Method
P
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-1
0
1
2
3
4
5
MU
n1 = 5, n2 = 5

FIGURE 2A

Conservative Retest Method for small p

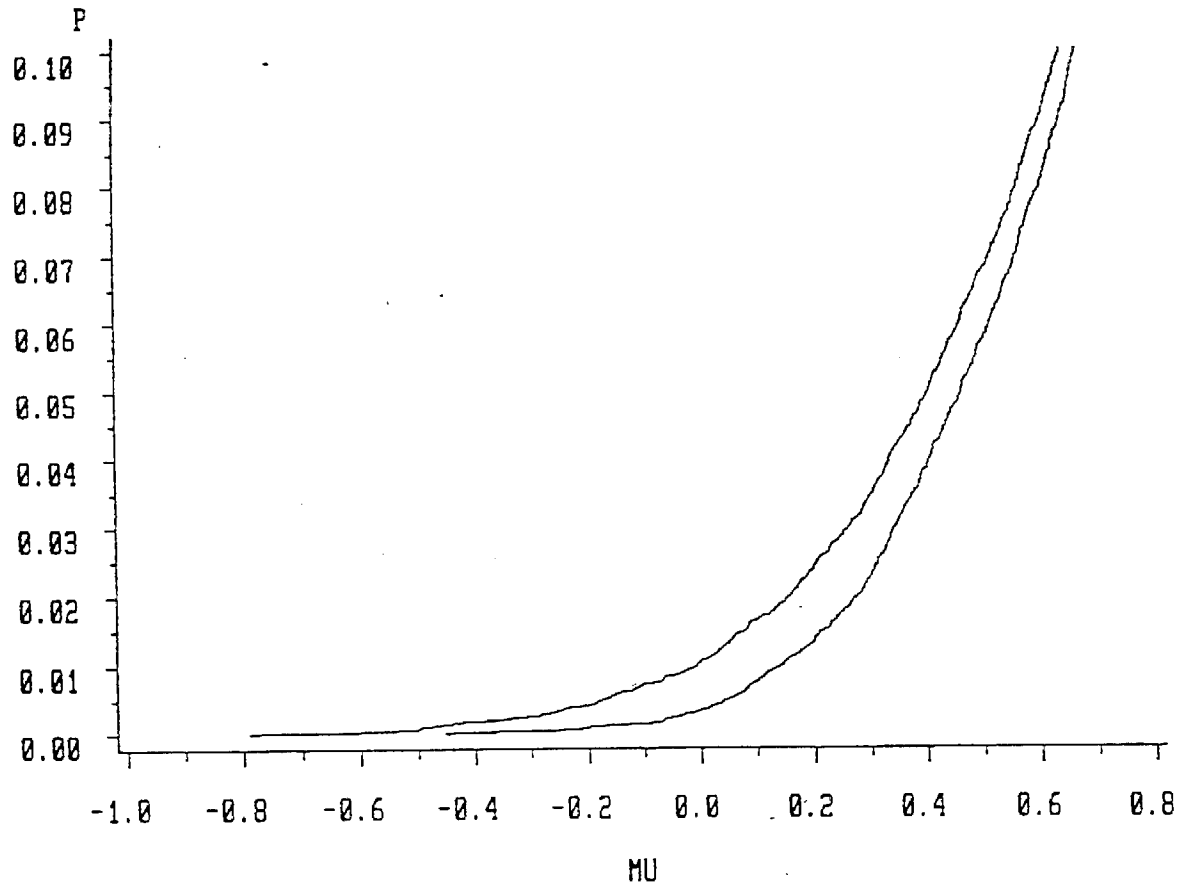

FIGURE 2B

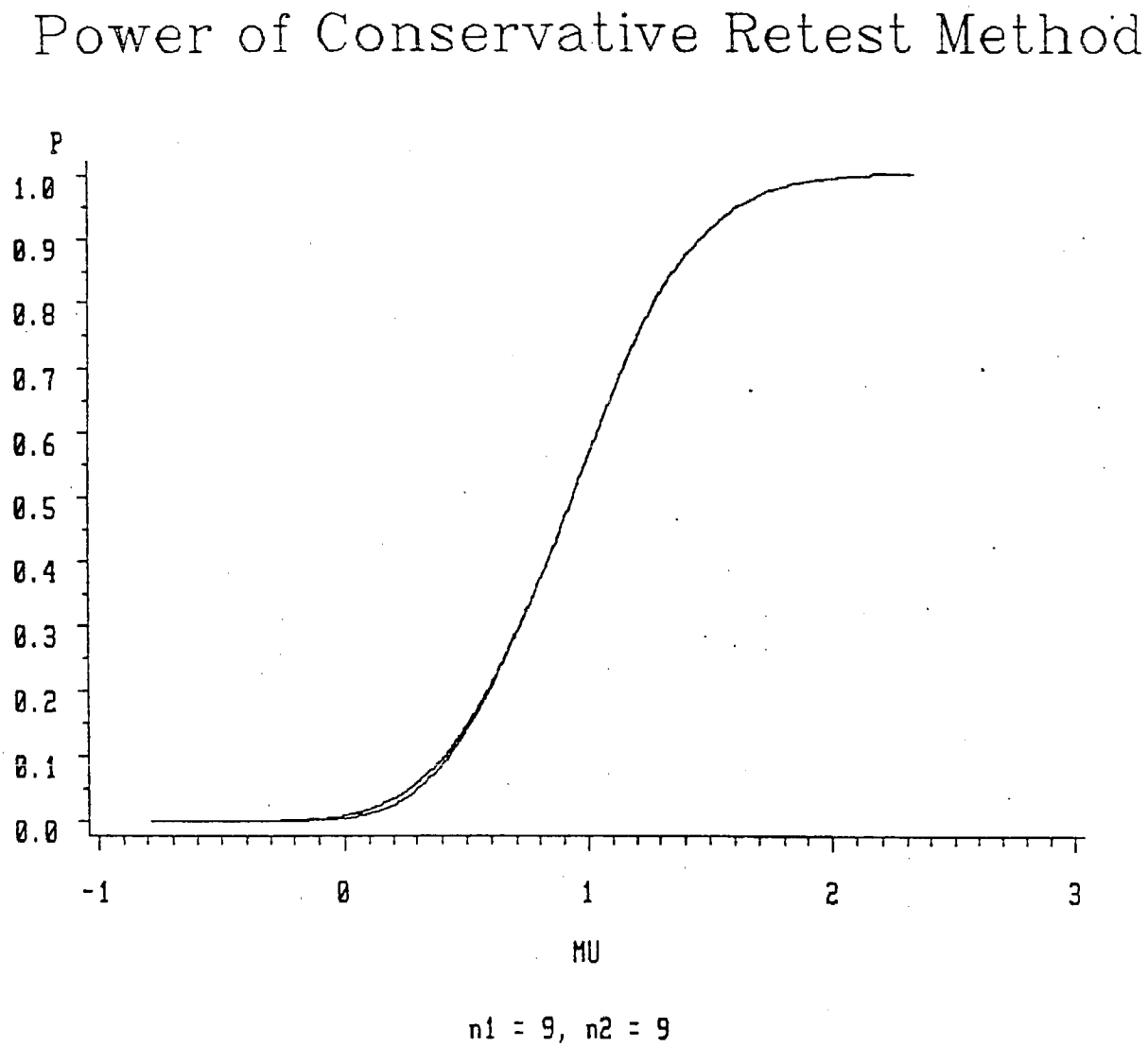
Power of Conservative Retest Method
P
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-1
0
1
2
3
MU
n1 = 9, n2 = 9

FIGURE 3A

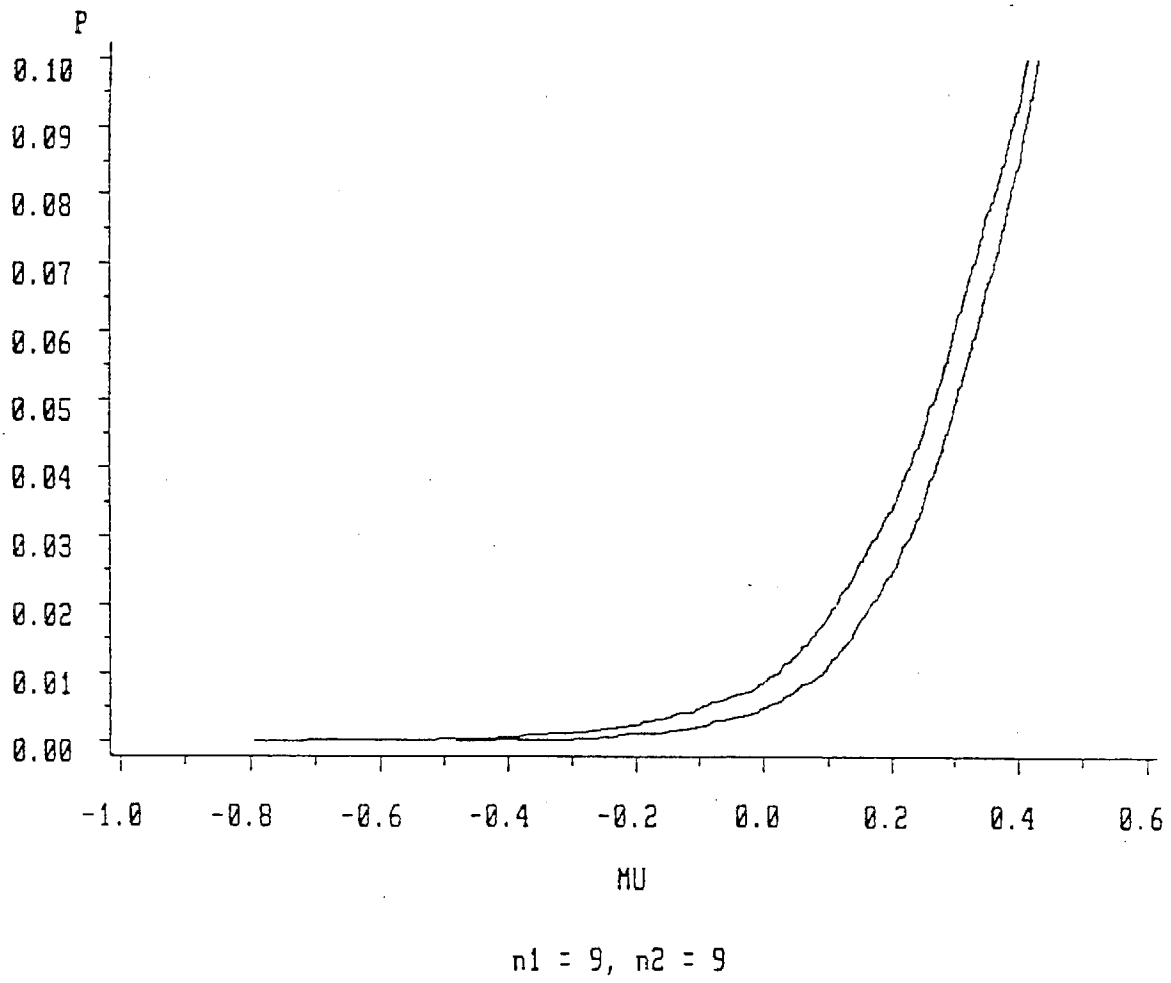
Conservative Retest Method for small p
P
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
0.4
0.6
MU
n1 = 9, n2 = 9

FIGURE 3B

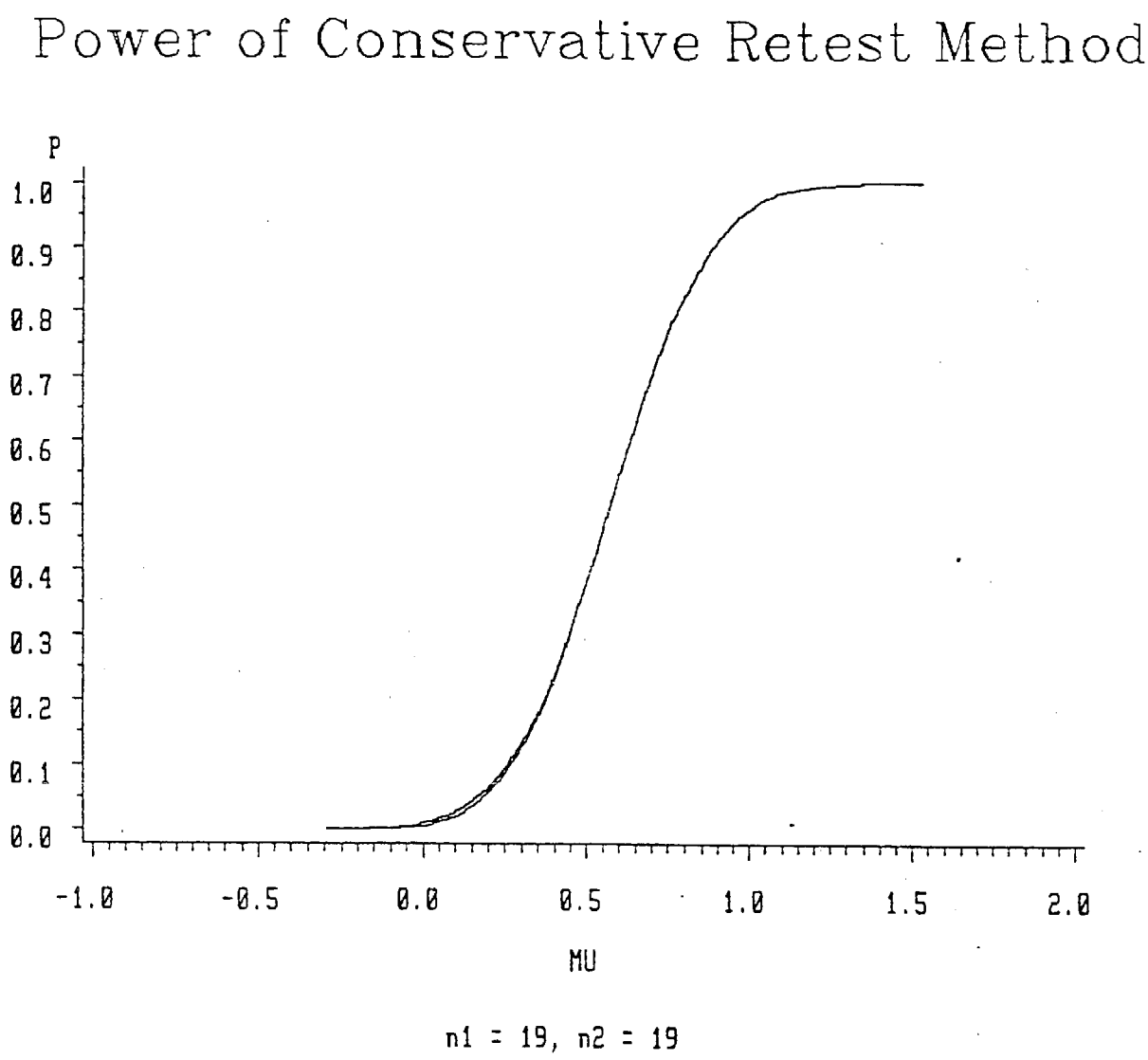
Power of Conservative Retest Method
P
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
MU
n1 = 19, n2 = 19

FIGURE 4A

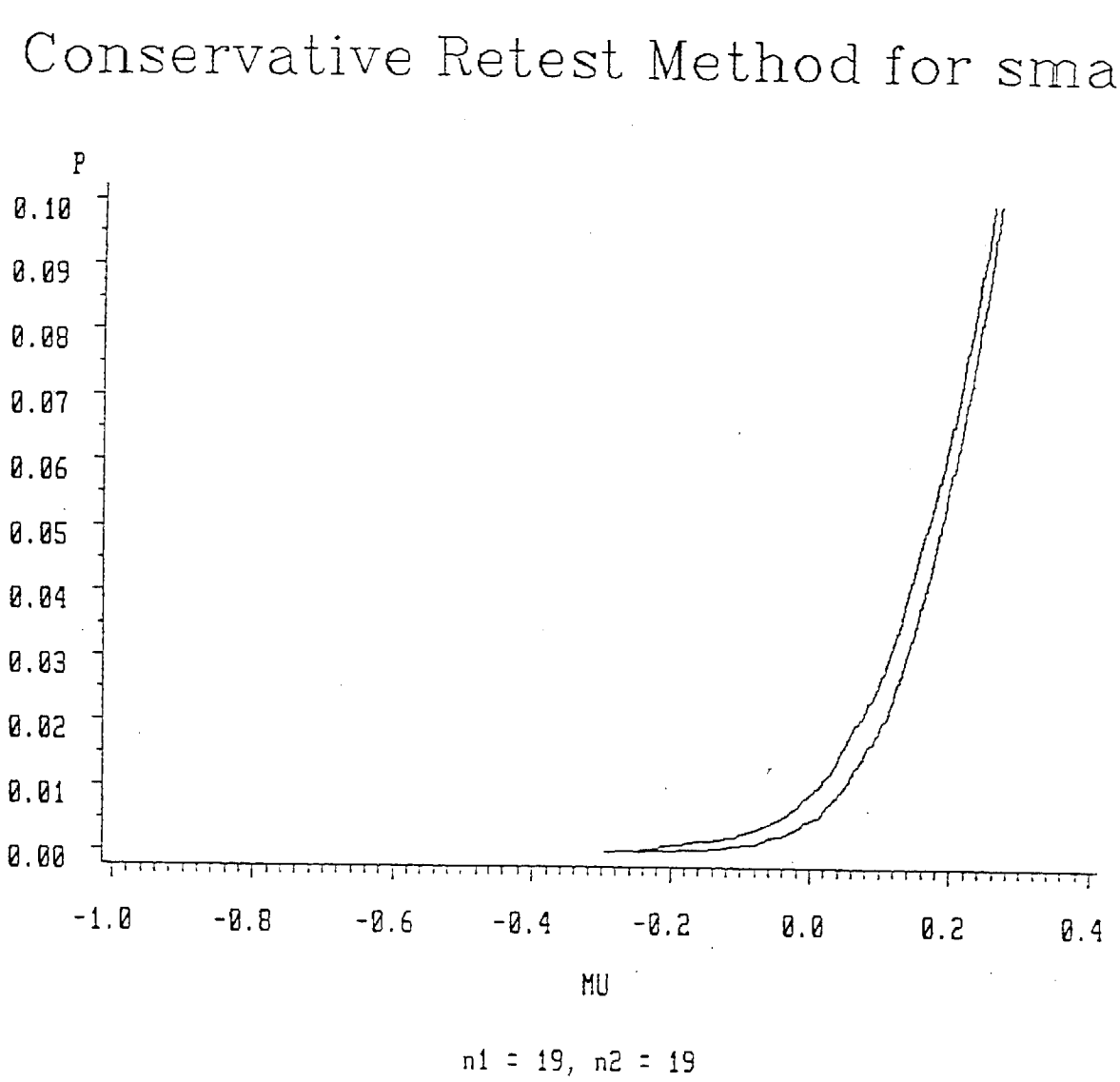
Conservative Retest Method for small p
P
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
0.4
MU
n1 = 19, n2 = 19

FIGURE 4B

Comment: It is not clear when the count begins on the seven days that Subsection (e)(8)(E)6. provides the discharger. Which "analysis" starts the seven day count: the laboratory analysis or the statistical analysis? If the former, then seven days is too short a time to carry out the statistical analysis, write a report on the result and submit the report. **[48L]**

Response: The regulations have been changed in response to this comment by clarifying that the submittal is required within seven days of the last laboratory analysis of the samples collected for the verification procedure. However, the seven-day period was not increased in length, because this subsection needs to be consistent with Subsection 2550.8(j)(1) which uses the same seven-day reporting period for the original indication of the release and which is required to demonstrate equivalency with the federal regulations of 40 CFR 264.98 which provide a seven day reporting period. It would not be appropriate to allow a longer reporting period after the retest than was allowed after the original indication. Seven days is sufficient time to carry out these actions.

Subsection 2550.7(e)(9)

The discharger is required to demonstrate to the satisfaction of the regional board that each of the statistical methods the discharger proposes satisfies all applicable performance standards under this subsection so that the data analysis results obtained through the use of the method can serve as a reliable basis for evaluating compliance with the Water Quality Protection Standard [Standard]. The data distributions for constituents can vary from each other considerably, even if the data is taken only from a single well. For the statistical method to carry out its intended function, the method must be compatible with the data distribution. Therefore, the discharger is required to substantiate the use of a proposed method separately for each constituent or parameter to which the discharger proposes to apply the method. The requirements under this subsection represent a nonsubstantial change from the federal requirements under 40 CFR 264.97(i) and are included for purposes of conforming with those regulations. These subsections are necessary to assure that the statistical methodology proposed by the discharger is protective of human health and the environment by reliably assuring the earliest possible

detection and measurement of a release and are appropriate for this reason to be used at all classified waste management units.

The error level [i.e., 0.05 experiment-wise error rate; and 0.01 for comparison-wise error rate] for all statistical methods is to be spread over a six-month interval so that there is no disincentive for a discharger to undergo statistical tests more often than twice yearly. Therefore, a discharger running statistical analyses on a quarterly basis has no more chance of having a false indication of a release force him/her toward corrective action than would a discharger running statistics every six months; however the more frequent statistical analysis provides an earlier indication in the event of a real release.

Comments on Subsection 2550.7(e)(9):

Comment: The tolerance limit and control limit statistical methods should include the potential for comparison to be made to both the upper and lower tolerance, prediction or control limits if the data (e.g., pH) requires a two-tailed analysis. **[18AG,25AG]**

Response: The regulations have been changed in response to this comment to enable two-tailed tests to be conducted, where appropriate.

Comment: The proposed regulations fail to specify how "non-detectable" concentrations are to be entered into the statistical calculation. **[36AB]**

Response: The regulations were not changed in response to this comment because the performance standards under Subsection (e)(9)(A) already require the discharger to analyze the data distribution and, if appropriate, propose either a distribution-free theory test [i.e., parametric] or a method to transform the data so that a normal-theory test can be used. Non-numeric data [i.e., "trace", or "non-detect"] can be analyzed via a distribution-free theory test, though such tests typically require a larger minimum number of samples per analysis than do normal-theory tests. Alternatively, a statistically viable method of converting the non-numeric data to its numerical equivalent can be proposed, taking advantage of algorithms such as those recently developed by Doctors Robert Shumway, Rhaman Azari and Phil Johnson of the University of California at Davis for use with air quality data bases containing some "non-detect" readings [see: R.H. Shumway, A.S. Azari, and P. Johnson,

"Estimating Mean Concentrations Under Transformation for Environmental Data With Detection Limits", **TECHNOMETRICS** (joint journal of the American Statistical Association and the American Society for Quality Control), Vol. 31 #3, August 1989, p.247-356].

Data Distribution [Subsection (e)(9)(A)]
This subsection requires the discharger to show that the proposed statistical method is the most powerful method of all those that are appropriate for the distribution of the concentration data to which it will be applied because this maximizes the chance that the results of the statistical analysis will reliably indicate any actual release and will be the least prone to giving false indications of a release.

Comments on Subsection 2550.7(e)(9)(A):

Comment: The regulations should permit prediction intervals to be used with non-normal distributions, as described in preamble to USEPA's Final Rule of October 11, 1988 [53 FR, No. 196, 39726, C. Prediction Intervals]. **[18AH,25AH]**

Response: The regulations were not changed in response to this comment because, contrary to the comment, the referenced portion of the USEPA preamble specifically recommends against applying prediction intervals to non-normal distributions. Nevertheless, this regulation does not preclude the use of any statistical test that can be shown to be the most likely to indicate a release.

Type I Error Rate [Subsection (e)(9)(B)]
This subsection represents a nonsubstantial change from 40 CFR 264.97(i)(2). This subsection provides a lower limit as to the frequency with which the statistical method shall produce a Type I error [false-positive] because a Type I error rate smaller than this decreases the effectiveness of the monitoring program. A false-positive determination occurs when the statistical test indicates that a release has occurred when, in fact, none has occurred. These Type I errors cause both the Regional Board and the discharger inconvenience because considerable resources may be expended needlessly attempting to delineate the nature and extent of a release that does not in fact exist.

Virtually all statistical methods permit the user to choose the Type I error rate that the method will produce. From the discharger's point of view, there is an advantage in keeping the Type I error rate as low as possible. However, if too low a Type I error rate is chosen, then the Type II [missed release] error rate goes up, permitting all but the most obvious releases to escape detection. Although the Type I error rate can be chosen, the actual Type II error rate can only be determined with great difficulty, based upon considerable data from the waste management unit.

The reciprocal relationship between Type I and Type II error rates dictates that a certain level of Type I error must be tolerated in order to retain the effectiveness of the test in determining the presence of a release. Avoiding the occurrence of missed releases is therefore accomplished by choosing a Type I error rate that experience shows to be the smallest that will still keep the more elusive Type II error rate in check.

This subsection sets the minimum Type I error rate for individual comparisons [one downgradient monitoring point against the background data] at 0.01 [one percent] over a six-month period. This means that one such comparison out of every 100 done in a six-month period will produce an indication of a release when in fact no release has occurred. For example, when a multiple comparisons method [e.g., ANOVA] is used to compare all of the downgradient wells with all of the background wells in a single test, the Type I error rates for the individual wells are summed to achieve an "experiment-wise error rate" which represents the combined likelihood of a false-positive indication during all such multiple comparisons tests [ANOVAs] that would be done during a six-month period. The experiment-wise Type I error rate for multiple comparison tests is held to no less than 0.05 [five percent]. These individual and experiment-wise error rate limits have been retained from the Subpart F regulations because the EPA has determined that they produce a workable balance between Type I errors and Type II errors [40 CFR 264.97(i)(2), and 53 FR <39723-39724> B.8.]. This limitation on the Type I error rate is necessary to maintain the power of the statistical method to discern a release.

This subsection does not apply to tolerance intervals, prediction intervals, and control charts because these categories of statistical methods require a different approach to Type I error level, however, a similar performance standard has been adapted to these tests and is included under the performance standards that specifically address these methods.

Comment on Subsection (e)(9)(B):

Comment: For clarity, the first sentence of this subsection should be rearranged to read as follows: "...compare individual monitoring point constituent concentration (or parameter value) with a concentration limit in the water quality protection standard (or with a background parameter value),...." **[27A57d]**

Response: The regulations have been changed in accordance with this comment, except that the parentheses have been omitted.

Control Chart [Subsection (e)(9)(C)]

This subsection represents a nonsubstantial change from 40 CFR 264.97(i)(3) [also see: 53 Federal Register 39726, Tuesday October 11, 1988, VI. General Description of Statistical Methods, D. Control Charts]. The discharger wishing to use control charting is required, pursuant to this subsection, to propose the specific type of control chart and to convince the Regional Board that the approach is valid for the constituent to which it is to be applied. In addition, the false-positive rate (for six months) may be no less than 1 percent per period and the upper control limit for X-Bar and R-Charts can be set at no more than 2.327 standard deviations from the mean for the statistic plotted [2.576 standard deviations for two-sided tests] because State Board statistical consultant Dr. David Rocke, of the Graduate School of Management, U.C. Davis, has determined that these limits provide the same sort of control over the Type I error rate for control charts as is provided under Subsection (e)(9)(B) for the ANOVA methods.

Control charts have the advantage of being able to make intra-well comparisons, wherein the monitoring point's background data forms the basis of comparison for the monitoring data that is produced during each testing period. This approach completely eliminates the effects of spatial variation because all data comes from the same geographic location and sampling depth, thereby precluding the possibility that spatially-induced variability between separate background and downgradient monitoring points could mask the presence of a release. A second advantage of the control charting method is that it provides a rapid, graphical method of analysis whereby the statistic [e.g.,

sample mean] is simply plotted on the chart. If the statistic plots above the upper control limit, then a release is indicated.

Tolerance or Prediction Interval [Subsection (e)(9)(D)]
This subsection represents a nonsubstantial change from 40 CFR 264.97(i)(4) (also see: 53 Federal Register, Tuesday, October 11, 1988, VI. General Description of Statistical Methods, B. Tolerance Intervals, and C. Prediction Intervals). This subsection also contains Type I error control limits which are specifically adapted to these tests by State Board statistical consultant Dr. David Rocke, of the Graduate School of Management, U.C. Davis for the purpose of providing the same degree of Type I error control for tolerance interval or prediction interval methods as is provided under Subsection (d)(9)(B) for the ANOVA methods.

Comments on Subsection 2550.7(e)(9)(D):

Comment: According to Subsection (e)(9)(B), the minimum Type 1 experiment-wise error rate of 5% does not apply to tolerance intervals, prediction intervals or control charts, however Subsection (e)(9)(D) requires these error rates for prediction intervals, thereby limiting this statistical method's application only to facilities with five downgradient monitoring points. **[18AI,25AI]**

Response: The regulations were not altered in response to this comment for the following reasons. Subsection (e)(9)(B) states that its contained performance standard requiring an experiment-wise error rate of no less than 5% does not apply to prediction intervals. This is because the wording of that performance standard is not appropriate for prediction intervals. Instead, a similar performance standard was crafted under Subsection (e)(9)(D) for prediction intervals. Therefore, there is no contradiction regarding this matter in the proposed regulations. In addition, the minimum 5% experiment-wise rate does not limit the discharger to having five downgradient monitoring points, as claimed by the commentors. The required minimum 1% error rate for individual monitoring point comparisons when combined with the minimum 5% experiment-wise error rate would mean that a unit with, for example, 10 wells would run individual well comparisons at a 1% error rate and an experiment-wise error rate of 10%. The 10% error rate would be the result of combining the effects of 10 individual wells whose individual error rate is 1% per well. Likewise, a unit with only two

downgradient wells would run individual well comparisons at a 2.5% error rate and an experiment-wise error rate of 5%. The two wells are tested at a 2.5% error rate (rather than 1%) so that the experiment-wise error rate does not fall below the minimum 5% level. These error rates are minimums, and they are simultaneously applicable.

Comment: For clarity, the phrase "or Monitoring Parameter" at the end of the second sentence in this subsection should be parenthetical. **[27A58a]**

Response: In response to this comment, the parentheses around the words "or values" have been removed [instead of adding more parentheses as suggested] because some Monitoring Parameters will be measured as concentrations while others may be measured by other means [e.g., pH, electrical resistance, turbidity, and specific conductance].

Non-Numeric Data [Subsection (e)(9)(E)]

This subsection represents a nonsubstantial change from 40 CFR 264.97(i)(5) [also see: 53 Federal Register <39721>/2. Methods to Analyze Below Detection Limit Data (sic)]. Parametric statistical methods can analyze only numeric data but require less samples to achieve the same power of discernment as compared to non-parametric methods which can analyze either numeric or non-numeric data [i.e., "trace" or "not-detected"]. Therefore, parametric methods have the advantage over non-parametric methods whenever numerical data involving a small number of samples is to be analyzed. If the data is primarily non-numeric, then a non-parametric statistical method must be used. However, if the majority of the data is numeric then a professional statistician can normally prescribe an appropriate method for assigning numeric values to the non-numeric data so that a parametric analysis can still be used. The more non-numeric data the data set contains the more difficult it is to adapt the data to parametric methods, therefore, all possible means must be used to maximize the proportion of numeric data in such cases. An effective, direct method of dealing with non-numeric data is to choose a laboratory analytical procedure which has a practical quantitation limit that is lower than that of other available procedures, so that a lower percentage of the data is assigned a non-numeric value. Therefore, this subsection provides that in such cases the available analytical method having the lowest practical quantitation limit shall be used so that the statistical method is made as robust as possible, resulting in

earlier, more reliable detection of a release from the waste management unit.

Comments on Subsection 2550.7(e)(9)(E):

Comment: This subsection should permit the use of facility-specific practical quantitation limits [PQL's] in cases where the PQLs listed in Appendix IX are not applicable. **[18Y,25Y]**

Response: The proposed regulations were not changed in response to this comment because the wording of the regulation does not preclude the use of facility-specific PQLs. The PQLs listed under Appendix IX are only to be considered for guidance purposes. However, this does not preclude the Regional Board from requiring substantiation that the proposed facility-specific PQL accurately reflects the matrix effects or other factors that are particular to the facility.

Comment: The word "quantification" should be replaced with the term "quantitation" in the this subsection. **[27A53e]**

Response: In response to this comment, the suggested change has been made to the regulations.

Seasonal/Temporal Variation [Subsection (e)(9)(F)]
This subsection represents a nonsubstantial change from 40 CFR 264.97(i)(6). This performance standard is necessary so that recognized sources of cyclic, temporal, or spatial variation in the background and downgradient wells can be isolated in the analysis from changes that are due to a release, thereby countering the possibility that such statistical "noise" could prevent the detection of a release from the unit.

Control of Outliers in Background Data [Subsection (e)(8)(G)]
This subsection is essential to ensure that the power of the statistical method is not decreased by removing non-valid outliers from the downgradient data while not at the same time removing such outliers from the background data. If not removed from the background data, such non-valid high concentration data will greatly increase the apparent variance of the background, thereby making small releases less detectable.

Subsections 2550.7(e)(10) and (e)(11)
The establishment of a reliable background value for each monitored constituent or parameter is essential because the performance of the statistical test in discerning or delineating a release is directly correlated with the degree to which the background data used in the test represents background water quality in the aquifer or other water body being monitored. Two approaches to establishing a background value are permitted in these regulations, because both produce reliable information under appropriate circumstances. The background value for a constituent consists of the mean or median of the concentration data at the background monitoring points and a measure of its dispersion about that mean or median [see also 53 FR <39723>/6. Determining Background Concentrations].

Comments on Subsections 2550.7(e)(10) and (e)(11):

Comment: The regional board will not be able to include methods for determining the background value if the discharger does not submit such proposed methods. **[41U]**

Response: The regulations were not changed in response to this comment because procedures for determining background values are essential to an effective monitoring program. If the discharger refuses to submit appropriate methods, the regional board has adequate enforcement authority to force the submittal [e.g., fines, cease and desist orders, etc.].

Comment: The regulations should provide for alternative methods of determining background water quality in instances where a site's background water quality cannot reliably be determined directly through the analysis of water samples. **[2D,26C]**

Response: The regulations were not changed in response to this comment for the following reasons. A lined waste management unit should not be allowed to operate unless it is not leaking, because wastes contained in lined units are inherently capable of causing degradation of waters of the State if they escape from the unit. Unlined units (some Class III landfills) should not be allowed to operate if they are causing degradation of beneficial uses of waters of the State. The only method that can reliably verify the integrity of waste management units involves the use of a properly designed and operated network of monitoring points and background monitoring points used in combination with an

appropriate statistical procedure to compare samples of potentially affected downgradient waters with samples of pristine upgradient waters. If representative upgradient samples cannot be obtained from a site, reliable statistical comparisons cannot be made to verify the integrity of the unit. Under such circumstances the site should be declared unsuitable for the siting of a waste management unit because site characteristics preclude the reliable protection of beneficial uses of waters of the State.

Proposing A Background Determination Procedure Under Subsection (e)(10)

The approach under Subsection (e)(10)(A) uses existing background data to establish a background value because such a data base can often provide an accurate representation of the background water quality. The resulting background value is written into the permit and is used in all statistical comparisons for that constituent or parameter from then on. This approach is only viable where the background data does not exhibit appreciable seasonal or temporal variation and where the most appropriate statistical procedure for that constituent or parameter is not adversely affected by the use of historical background data. When such is not the case, the second approach, under Subsection (e)(10)(B), is used.

Subsection (e)(10)(B) permits the background value to either be calculated anew each time a statistical test is carried out or be updated on a cyclic basis in order to accommodate either temporal variation in the data or to increase the power of the statistical test. This subsection does not specifically list the approaches which could be used because these are myriad and because no one method would be viable in all situations. Regardless of the method proposed, the discharger is required under Subsection (e)(10) to justify the use of the specific method. However, a few of the approaches that could be proposed under this subsection include: use of contemporaneous background data; use of pooled background data [e.g., all data to present]; use of a yearly moving average or a moving average based upon some other time span; or use of pooled background data by season [in cases of seasonal variation].

Comments on Subsection 2550.7(e)(10)

Comment: It is unclear whether or not background data collected under the Solid Waste Assessment Test [SWAT] can be used to comply with these subsections. **[23N]**

Response: The wording of the proposed regulations was not changed in response to this comment because the proposed regulation allows the discharger to propose the method by which the background value for the unit shall be determined. If the background data collected under the SWAT program is of good quality and is appropriate for use with the statistical methods proposed by the discharger, then the wording of Subsection (e)(10) permits this previously collected data to be incorporated.

Comment: For consistency with Subsection (e)(11)(B) of this section, Subsection (e)(10)(B) should begin "A procedure for establishing and updating the background value...." **[27A58b]**

Response: The regulations have been changed in accordance with this comment.

Comment: Subsection 2550.7(e)(10)(A) should be modified to account for variation caused by off-site human activities [e.g., nitrate variation]. Insert the phrase "or have variation which reflects off-site activities" at the end of this subsection. **[37U]**

Response: In response to this comment, the wording of this subsection has been changed by replacing the phrase "natural variation" with "variation".

Comment: The phrase "greatest power to the statistical method" in Subsection (e)(10)(B) should be changed to "most appropriate value for comparative purposes". **[37V]**

Response: The regulations were not changed in response to this comment because the existing wording specifically conveys the intent of the Regulation Development Unit, whereas the language proposed by the commentor does not. The use of an alternative background method is appropriate only in those cases where its use will enhance the effectiveness of the monitoring and response program being applied.

Regional Board Review of Proposed Background Determination Methods Under Subsection (e)(11)

This subsection is necessary in order to provide both the discharger and the Regional Board with an established procedure for the approval of proposed background determination procedures and including them into the Waste Discharge Requirements.

Subsection 2550.7(e)(12)

This subsection represents a nonsubstantial change from 40 CFR 264.97(g) [see also: 53 FR <39724>/9. Time Intervals for Ground-Water Sampling], except that the proposed subsection addresses all media and, provides a lower limit to the sampling frequency [i.e., quarterly sampling] to maintain the minimum standards of repealed Article 5.

The sample size [i.e., number of samples per statistical testing period], the sampling method, and the interval between successive samples are factors which influence the reliability with which the monitoring and response program achieves its specific performance objective. The requirements under this subsection are necessary to assure that data used in statistical analyses are as representative as possible of in-situ water quality and that there is enough data for the statistical method to reliably achieve the specific goal of the monitoring and response program.

Under repealed Article 5 (and the pre-October 11, 1989 USEPA regulations of 40 CFR 264 Subpart F), the discharger was required to split a single sample four ways and treat these aliquots as four separate samples. While expedient, this method actually gave no more information than would a single quarterly sample because the same parcel of water was being split up for analysis; therefore, that method tended to test the repeatability of the laboratory determinations rather than variations in the quality of water at the monitoring point. Statistical inference, when applied to water quality analytical data, is based upon the assumption that each datum is independent of the other data. The splitting of a single sample into four aliquots violates this assumption because the four aliquots will all share the characteristics of the single sample from which they were taken. Therefore, the revised regulations require relatively independent samples, as defined in Subsection (12)(B). This requirement is necessary for the proper functioning of any statistical method used.

For the purposes of these regulations, the requirement for independence of samples is satisfied if each sample is retrieved from water which was not capable of being drawn into the sampling equipment during the preceding sampling event. In other words, for the ground water medium, the parcel of water in the well bore during one sampling event must not be present in the well bore during the taking of the next sample. The USEPA approach to achieving sample independence is to wait until the water in the aquifer has moved under natural flow conditions a distance equal to the well bore diameter prior to taking the next sample. The USEPA approach relies upon an assumption that the water in the well bore moves in a manner similar to that in the aquifer and that this water will not be drawn back into the well bore while purging the well prior to taking the next sample. In the opinion of State Board staff, these assumptiond are both incorrect because the flow patterns in and around the gravel pack, slotted screen interval, and in the wetted casing above the slotted interval will be extremely complex in comparison with the flow patterns in the aquifer itself. Therefore, it is not reasonable to assume that the previously-sampled water in the well bore has moved one well bore diameter downgradient just because the water in the aquifer has done so. In addition, even that portion of the previously-sampled water that **has** moved downgradient is very likely to be drawn back into the well bore during purging prior to the next sampling event, thereby sacrificing sample independence to the degree that it dilutes previously-unsampled water in the well bore.

An alternative approach for assuring sample independence was considered which involved using mass-flow equations to determine the distance that the previously-sampled water in the well bore would have to travel in order to avoid being drawn back in during the next sampling episode. This approach was rejected because it would have to rely upon the same sort of simplifying false assumptions that the USEPA approach relies upon [e.g., the false assumption that the water in the well bore and casing moves in accordance with the mass-flow equations that apply in the aquifer itself].

Because of the need to assure sample independence, the regulations stipulate that each monitoring well shall be purged immediately after sampling. In this way, the just-sampled water in the well bore is **removed** so that no future sample has any chance of including it. This approach is simple and provides the additional benefit of keeping considerations of sample independence from dominating the choice of sampling frequency.

Although no method can be demonstrated to provide perfect sample independence, purging immediately after sampling a well assures to the greatest extent possible that an independent sample is obtained at each sampling event.

Subsections (12)(B)1. and (12)(B)2. present two types of sampling method for the regional board to choose from. The method of Subsection (12)(B)1. requires at least eight samples per year from each background and downgradient monitoring point and statistical analysis at least once every six months. The alternative sampling method, under Subsection (12)(B)2., is to require as few as one sample quarterly per monitoring point and background monitoring point, but with the additional proviso that statistical analysis shall be carried out for each downgradient sample. This alternative approach retains the sampling frequency required by repealed Article 5 because that minimum sampling frequency has proven effective on waste management units to date and because this requirement, in conjunction with the use of modern statistical methods, will increase the reliability with which releases are detected. The regional board will determine the appropriate sampling method based upon site-specific conditions and the needs of the statistical method employed.

For surface water samples, the interval between successive samples may be quite short, as surface water circulates much faster than does ground water. Soil-pore liquid samples may or may not be available on demand. In addition, the speed of movement of soil-pore liquid is very difficult to predict. Therefore, the sampling interval for soil-pore liquid may need to be tailored to reflect site-specific characteristics.

Comments on Subsection 2550.7(e)(12):

Comment: The phrase "times of expected highest and lowest annual elevations of the ground water surface" is unclear and should be replaced by a seasonal time frame. **[18AO,25AO]**

Response: The regulations were not changed in response to this comment for the following reasons. A season-wide time slot for collecting samples pursuant to this subsection, as suggested by the commentor, encompasses far too broad a span of time. The discharger will have a much closer estimate than this of the typical time during the year when the ground water surface reaches its highest and lowest points because this sort of information is gathered and submitted as part of the hydrogeological portion of the initial Report of Waste Discharge

required pursuant to Section 2595 of this chapter. Therefore, the appropriate "time" during the year when these events are expected to occur will be established using the detailed site-specific ground water knowledge gained by the discharger and submitted as part of the initial Report of Waste Discharge. In light of the fact that this site-specific knowledge is a prerequisite to obtaining Waste Discharge Requirements, the wording of the revised subsection is easily understood.

Comment: The requirement in Subsection 2550.8(f) **[ED: this language now consolidated under Subsection 2550.7(e)(12)(B)]** for the Regional Board to specify the frequencies for collecting samples and doing statistical tests is redundant because the frequency of sampling is already specified pursuant to Subsection 2550.8(e).**[18AM,25AM]**

Response: The regulations were not changed in response to this comment because the comment is incorrect. Subsection 2550.8(e) is involved with the establishment of the Monitoring Parameters that will be used, and does not involve the specification of the frequency with which these Monitoring Parameters will be monitored and statistically analyzed. Therefore, there is no redundancy.

Comment: Part of Subsection (e)(12)(B) reads as follows in the November 6, 1990, version:

> "...obtained. To assure sample independence for ground water, wells shall be purged immediately after sampling to the extent necessary to remove the parcel of water that was in the well-bore at the time of sampling. The...."

This sentence implies that true sample independence is achieved through the purging of only one well volume. It is our position that the term "sample independence" should take into account ground water flow rate and the radius of influence created by well purging in addition to well bore volume. True sample independence is achieved when a minimum time span is allowed for the ground water adjacent to the well to travel a distance at least equal to two times the radius of influence created by purging the well. This time span would allow the upgradient edge of the radius of influence to travel past the well a distance such that the following sample will not simply retest a parcel of ground water with the same characteristics as that tested during the previous sampling event.

We take the phrase "to the extent necessary" in this subsection to mean that a regional board could accept an alternate method for assuring sample independence; thus the purging of one well bore volume after sampling would not be "necessary" because the alternate method has already assured sample independence. Similarly, we believe that this wording would not preclude the regional board from assuring sample independence by allowing sufficient ground water movement to pass a well between subsequent samples that independence is assured. **[69A{pages 1-3}]**

Response: The regulations were changed in response to this comment in order to clarify the purpose and use of post-sampling purging. The changes made to this subsection and to the definition of "independent sample" in Article 10 of this chapter in response to this comment were made after the close of the 15-day public comment period on November 27, 1990; however, these changes are editorial in nature and, therefore, do not require the proposed regulations to undergo an additional public comment period.

In addition, Mr. Bud Eagle, Chief of the Regulation Development Unit, provided a direct answer to this commentor in a letter, the text of which follows:

> "Thank you for your letter of 29 November with your comments on the proposed modifications to Articles 5 and 10 of Chapter 15, Division 3, Title 23 of the California Code of Regulations. We are pleased that Waste Management of North America, Inc., and Chemical Waste Management, Inc., support the proposed modifications.
>
> "With regard to your request for clarification of that portion of Section 2550.7(e)(12)(B) that states:
>
> > 'To assure sample independence for ground water, wells shall be purged immediately after sampling to the extent necessary to remove the parcel of water that was in the well-bore at the time of sampling.',
>
> our intent is that the sentence be interpreted literally and that post-sampling purging is mandatory. As you know, prior to the October 11, 1988, revisions to Subtitle C of RCRA, the specified procedure for sampling a monitoring well was to take a single sample from the well and to split it into four aliquots for analysis. EPA then became aware of the fact that the four aliquots did not represent four separate

samples but represented one sample split into four portions. To remedy this situation, EPA revised Subtitle C of RCRA on October 11, 1988, modifying the sampling protocol by prohibiting the splitting of one sample into four and requiring that four separate samples be taken.

"During our October 18, 1990, meeting with you, we discussed the issue of sample independence and explained how Jim Brown of EPA Headquarters in Washington, D.C., had informed us that for EPA's purposes, if water which was in a well bore at the time of a previous sampling event is excluded from samples taken during a subsequent sampling event, the samples from the two sampling events are independent. The underlying rationale being that taking four successive samples from a parcel of water within the well bore is little different than withdrawing one sample from the well and splitting it into four portions. It is clear, therefore, that EPA's concern is confined to the water within the well bore. Therefore, the objective of Section 2550.7(e)(12)(B) is to purge the water in the well bore before it has moved out into the aquifer, thereby precluding any portion of that water parcel from being drawn back into the well bore and being included in samples taken at subsequent sampling events. The number of well-bore volumes that would be necessary to purge the well is variable but would be no greater, and possibly less than, the number of well-bore volumes withdrawn for the pre-sampling purging. By performing post-sampling purging, there can be no question whether EPA's criterion for "independence" has been satisfied.

"As you noted in your letter, you believe that we should be concerned with the parcel of water defined by the radius of influence produced when the well is pumped for sampling (which would be much grater than the parcel of water defined by the well-bore). Your rationale appears to be that ground water characteristics are some how correlated with the radius of influence per se. We know of no technical reason why this should be true. We understand that, theoretically, it is possible that some effects might take place as the result of reduced hydrostatic pressure caused by pumping. However, only a few specific parameters would be subject to these effects, and these need not be used for detection monitoring. But more importantly, such effects can not be avoided because identical conditions are created when pre-sampling purging (which is mandatory) is performed.

"Consequently, when initiating sampling, it is necessary to be concerned with excluding only the ground water that was within the well bore at the time of a previous sampling event, not the ground water defined by the radius of influence of a previous sampling event. Therefore, when any water that is outside of the well bore (and which has never been within the well bore) at the end of a sampling episode enters the well bore, that ground water constitutes an independent parcel of water, and it is irrelevant whether it came from within the radius of influence of a previous sampling event.

"Clearly then, the problem to be addressed in achieving independence is preventing water which was residing within the well bore during one sampling event from being included in subsequent sampling events. Theoretically, this could be achieved by allowing enough time between sampling events for any water that was in the well bore at the time of the last sampling event to migrate out of the well bore into the aquifer and move far enough down gradient of the well to be beyond the radius of pumping influence of the next sampling event. However, as you know, it is extremely difficult to determine, with any degree of reasonable certainty, how long an interval would be needed to insure that the well-bore parcel of water had migrated beyond the radius of influence of the pump. Additionally, the interval necessary to assure independence between sampling events could preclude sampling at optimum intervals.

"On the other hand, preventing the well-bore water from ever migrating into the aquifer by performing post-sampling purging eliminates uncertainties regarding independence, thereby precluding any subsequent uncertainties as to the validity of the monitoring data. Additionally, post-sampling purging allows sampling frequencies to be chosen on the basis of optimum timing rather than being dictated by the position of a down-gradient parcel of water.

"Because of the substantial benefits to be realized through post-sampling purging and the drawbacks associated with waiting for the natural flow of ground water to transport any unwanted water beyond the radius of influence, we intend that post-sampling purging be mandatory and not subject to alternative procedures. However, we do not intend that post-sampling purging be substituted for pre-sampling purging because these two operations are performed for distinctly different objectives. Your comment that there could be some

confusion as to our intent as the regulation is now written is well taken, and we will modify the language to remove the chance of misinterpretation.

"In addition, the requirement to purge **after** sampling is potentially confusing because wells are typically required to be purged prior to sampling."

Comment: This subsection requires monitoring wells to be purged immediately after sampling "to the extent necessary to remove the parcel of water that was in the well-bore at the time of sampling." Current thinking in groundwater monitoring is to require well purging until the field parameters of pH, electrical conductivity, and temperature stabilize. Alternate methods allow for the purging of three times the casing volume of water standing in the well. Professional literature in the field of well purging suggest that even these two methods may be inadequate to determine the true quality of the aquifer. Clearly, the removal of only the stagnate water in the well at the time of sampling is not adequate or representative of the quality of the aquifer as a whole. **[68G{page 4}]**

Response: The regulations have been modified in response to this comment to clarify the distinction between pre-sampling purging and post-sampling purging. Contrary to the comment, this subsection does not address the purging that must be done **prior to** sampling at a well, for the purpose of eliminating water that has been in long contact with the atmosphere and with the wellscreen. Instead, this subsection requires purging **after** sampling for the purpose of removing the just-sampled water in the well-bore so that there is no posibility of it's being resampled during the next sampling event. These two purgings are carried out for entirely different reasons and at different times. Therefore, the after-sampling purge is unrelated to the purging that is done prior to sampling and there is no conflict.

Comment: In EPA publications on the issue of sampling frequency the decision as to a relative minimum sampling frequency was determined from the actual synthesis of the data itself. That is, the minimum sampling frequency is concluded form the local data, and not a generalized sampling frequency constant. Using the local data trends to determine sampling frequency aids in offsetting the many uncertainties involving aquifer characteristics, geologic characteristics, among other effects.

Therefore, with respect to statistical inferences that impact public health and safety, a uniform (i.e., Class I, II, and III) sampling frequency of 8 tests per year is preferable to a policy allowing less frequent tests per year. **[67T {pages: 52,57}]**

Response: The regulations were not changed in response to this comment for the following reasons. The EPA approach could be used to allow a single sample per year or even less frequent sampling because the EPA regulations provide absolutely no performance standard or other limitation upon the sampling frequency used in the "alternative" sampling scheme nor do the federal regulations provide conditions when such an alternative could be proposed. Article 5 preserves the workable quarterly minimum sampling frequency that has been a part of Chapter 15 since December, 1984. This quarterly sampling is a **minimum**, and the regional board can specify a more frequent sampling rate in cases where that is appropriate. State Board staff finds this approach distinctly preferable to the open-ended approach in the federal regulations.

In addition, the comment seems to contain a non-sequitur: the commentor suggests that local data trends should dictate the sampling frequency, yet the commentor suggests a minimum frequency of eight samples annually.

Under the revised language of this subsection, all classes of waste are subject to the same sampling frequency options.

Comment: Arguments that an increased testing frequency produces no benefit are not valid because with even negligible groundwater flow velocity, the increased sampling will result in statistical estimates that reduce both Type I and Type II errors. **[67S {pages: 52,57}]**

Response: The regulations were not changed in response to this comment because commentor neither supports this argument in a compelling manner nor provides examples by which an independent, reasonable person could decide for or against the argument.

Dr. Neil Willits, State Board statistical consultant, had the following to say in response to this comment.

> "Increased sampling can be used to reduce the Type II error rate, but it wouldn't reduce the Type I error rate. The language of the multiple independent retest involves the gathering of additional data when the original data are

suspect, and in so doing, reduces the Type II error rate while leaving the Type I error rate unchanged."

Comment: In the September 7, 1990 draft of the article, Subsections 2550.7(e)(12)(B)1.-3. specify a different number of samples for Class I and Class II units as opposed to Class III units. Class III units often can present an even greater threat to water quality than do Class I or Class II units; therefore, a high sampling frequency should be required of all classes of unit. In addition, the sampling frequency should be based upon the transport velocity of the contaminant rather than upon the flow velocity of the groundwater (e.g., diffusive contaminants can travel faster than slow-moving groundwater). **[67Q {pages: 30,52,57}]**

Response: In response to this comment, the regulations have been revised to remove the distinction between different classes of waste with respect to the minimum sampling frequency. The requirement to tie the sampling frequency to the groundwater flow rate has also been removed. However, a requirement to tie the sampling frequency to transport velocity has not been included because that is only one of many factors that should be considered. The specific factors which should be considered as well, as the relative importance of each such factor, will vary according to the situation [the site hydrogeology, the constituent involved, etc.]. The purpose of the original groundwater flow language was to help control sample independence in the groundwater medium. With the new requirement to purge the well immediately after sampling, there was no further need to control sample independence because it has ceased to be a factor needing consideration when setting the sampling frequency. The revised wording allows the regional board to make a site-specific decision as to the appropriate sampling frequency.

Comment: Purging a well immediately after sampling, as required in Subsection 2550.7(e)(12)(B), should not relieve the discharger from properly purging the well prior to sampling. This subsection should be reworded to require purging prior to sampling as well as after sampling. **[67I {pages: 24-25}]**

Response: In response to this comment, the wording of this subsection has been altered to clarify that the post-sampling purging procedure is distinct and separate from the pre-sampling purging. [See also the response to comments 67G and 69A addressing this subsection.]

Comment: Subsections 2550.7(e)(12)(B)1.-3. appear to be ignoring the hydrogeology of the site because all references to making sampling dependent upon the groundwater velocity have been deleted. **[67G {page 10}]**

Response: The regulations have not been changed in response to this comment for the following reasons. The deleted wording was originally intended to guide and constrain the determination of the length of time necessary to wait for the well to flush itself of previously-sampled water so that the succeeding sample would be independent [i.e., would contain no water that was in the well-bore during the previous sampling episode]. In the course of the rulemaking, it became clear that it would not be possible to reliably determine the appropriate waiting period between samples. In addition, it seemed that the issue of sample independence could be used to fuel a move toward very infrequent sampling. Therefore, the issue was eliminated by requiring that monitoring wells be purged immediately after sampling. The post-sampling purge eliminates the water that was in the well-bore at the time the sample was taken, thereby assuring that the next sample can be taken at any time without its validity being questioned on the basis that the sample contains previously-sampled water. This change frees the sampling interval from being driven by considerations of sample independence. The groundwater velocity language was removed because it no longer served its intended purpose of clarifying the means by which sample independence is assured.

Comment: The proposed rule requires four independent samples be taken on a frequency based on the hydrogeologic factors, but requires them to be taken a minimum of every six months. However, if the hydrogeologic conditions are such that ground water, surface water, and perched liquids flow so slowly that four independent samples cannot be taken even on a quarterly or semi-annual basis, then the rule has no suggestions. The preamble to EPA's rule states:

> "In hydrogeologic environments where groundwater velocity prohibits one from obtaining four independent samples on a semi-annual basis, then an alternate sampling procedure approved by the regional administrator may be utilized." [40 CFR 264.97(g)(1) and (2)]

Such conditions exist at Kettleman Hills and sites that monitor the San Francisco Bay Muds, for example.**[56E]** The criteria given in Subsection (e)(12)(B)1. [**ED: September 7, 1990 draft**] for independence is over-restrictive and is not consistent with fundamental hydrogeological principles. Because of the effect of purging, it is physically impossible to collect truly independent samples if groundwater has moved only the distance equivalent to the monitoring well bore diameter since the previous sampling episode (i.e., previously-sampled water is drawn back into the well-bore). Independence is site-specific and is based upon soil porosity, flow gradient and velocity, specific yield, specific retention, depth to groundwater, ground water quality, purging effects, and other hydrogeologic factors; therefore, the decision as to sampling frequency should be left to the discretion of the regional board.**[61A,63D,65A]**

Response: Comment No. 56E identified an area of the proposed regulations which could have been misinterpreted. The regulations were changed in response to this comment to clarify the intent; however, as substantiated in the following discussion, the changed wording runs counter to the above commentors' suggestions by intentionally disallowing the issue of sample-independence to dominate the sampling frequency issue.

Sample independence is one of the assumptions upon which most statistical inference is based. The federal approach to providing sample independence in the groundwater medium is to avoid resampling the parcel of water that was in the borehole during the previous sampling episode. This approach, if carried out successfully, provides sample independence by assuring that each successive sample represents a different parcel of groundwater. The federal method of achieving this goal is to wait long enough between successive sampling events for natural flushing to remove the previously-sampled parcel of water from the well-bore. The flaw with this approach is that the duration of time necessary to achieve this goal cannot be calculated with reasonable certainty because the complex flow patterns in and around the well-bore differ from the flow pattern found in the surrounding aquifer. Existing mathematical models to predict groundwater flow patterns are applicable only to the aquifer itself, not to well-flushing. Therefore, there exists no way to accurately predict a sampling interval that will provide sample independence.

This flaw in the federal approach could result in delays to site remediation by permitting the validity of statistical indications of a release to be called into question. Therefore, the State

Board chooses to make this point moot by requiring all wells to be purged immediately after sampling. By using this approach, the water that was just sampled in the well bore is precluded from being sampled during any subsequent sampling episode; therefore, the sampling frequency ceases to be a function of sample independence and visa versa.

Comment: Quarterly sampling has served well in the past and its use should be continued. The sampling frequency should be based on variability of water quality as well as independence of samples. Although a given duration of time between successive samples may be sufficient to provide independence, local changes in water quality may be quite small in the same time period. Frequent sampling is appropriate when attempting to establish a background data base; however, subsequent sampling should be, in most cases, less frequent. **[63E]**

Response: In response to this comment the regulations have been modified to provide the regional board with more flexibility in choosing the sampling frequency. In addition, sample independence has been removed as a prime determinator of sampling frequency by requiring that wells be purged after sampling. This post-sampling purge removes nearly all of the water that was in the well-bore at the time of sampling, thereby assuring that the next sample taken will represent a parcel of water that has not previously been sampled (i.e., the samples will be independent). However, it is not appropriate to base sampling frequency upon the variability of water quality because the statistical method takes that variability into account and because it is not appropriate to take a sample only when it is expected that the water quality has changed a measureable amount. It is the reliable detection of the unexpected change (i.e., the arrival of a plume of contamination) which is the primary purpose of the monitoring effort; this has little or nothing to do with trends and seasonal fluctuations in background water quality.

Comment: The use of "quads" [i.e., averaging of four samples in six months instead of quarterly comparisons on a single observation] in the proposed regulations is a problem. Regardless of the hydrogeologic conditions, we agree with Dr. Gibbons [see Comment 54A in the portion of this SOR addressing Subsection (e)(12) of this section] that averaging environmental data for statistical comparisons for both detection and verification monitoring programs at a frequency of two time per year is far less sensitive and results in higher false-

positives and false-negative. In essence, more expensive sampling and analysis result in a less effective and less environmentally-protective program.**[56F]**

Response: The regulations were not changed in response to this comment for the following reasons. The referenced comparison by Dr. Gibbons compares the use of the ANOVA method and the Dr.'s own method under conditions which are inappropriate for an ANOVA. It is not surprising that under such conditions the ANOVA method did not perform as well, even though the ANOVA required the taking of twice as many samples. However, Dr. Gibbon's method is not likely to be universally applicable and the ANOVA method works very well under the right conditions, so long as at least four samples are provided per analysis. Therefore, the use of "quads" is retained in the regulations as one of the options available to the regional board, the other being to have less than eight samples annually (as few as one sample quarterly) with statistics being run each time a sample is taken.

Comment: The sampling requirements under Subsections 2550.8(f) and (g), and 2550.9(e)(3) and (e)(4) should be consistent with the general sampling requirements set forth in Subsection 2550.7(e)(12).**[46J]**

Response: The regulations were not changed in response to this comment because the comment is unclear. The sited portions of Sections 2550.8 and 2550.9 address monitoring that is carried out under detection monitoring and evaluation monitoring for Monitoring Parameters and for Constituents of Concern. The regulations require that this monitoring be carried out in accordance with the provisions of Subsection 2550.7(e)(12), which addresses sampling frequency and the determination of the background concentration of each Monitoring Parameter and each Constituent of Concern. There is no apparent inconsistency between the cited subsections.

Comment: The regional board will not be able to include methods for determining the background and monitoring sampling methods if the discharger does not submit such proposed methods.**[41V]**

Response: The regulations were not changed in response to this comment because procedures for determining background and monitoring sampling methods are essential to an effective monitoring program. If the discharger refuses to submit appropriate methods, the regional board has enforcement authority

to force the submittal in a timely manner [e.g., administrative civil liability, cease and desist orders, etc.].

Comment: The minimum of four samples per sampling period required in this subsection may not be applicable to waste management units handling non-hazardous waste.**[230]** The lack of an alternative to having at least four samples for each monitoring point is inconsistent with the equivalent requirements under RCRA regulations of Subtitle C. Under the RCRA approach an "alternate" sampling method can include the use of less than four samples per sampling period; whereas under proposed Article 5 the alternate method must include at least four samples [see Subsections 2550.8(f) and 2550.9(e)(3)]. **[45A]**
Subsection 2550.7(e)(12) requires at least four samples per sampling period. This is burdensome to the discharger because of the increased time spent in the field obtaining samples. This requirement should either be deleted or should be modified to require only two independent samples per testing period.**[48C,48M]**

Response: The regulations were changed in response to these comment by allowing for an alternative sampling frequency of as little as one sample quarterly, provided that statistical analysis be carried out following each sampling event. It should be noted, however, that some combinations of site conditions, constituent concentration, and statistical method will require at least eight samples per statistical analysis in order to satisfy the sample-size performance standard under Subsection (e)(12)(A); therefore this minimum quarterly sampling frequency should not be assumed to be a basic given. The proposed article is consistent with the corresponding federal regulations, but is more stringent in that it provides no variance to the four-sample minimum [i.e., the federal regulations provide no minimum frequency].

Comment: For clarity, Subsection (e)(12)(B) should begin as follows: "For each Constituent of Concern and for each Monitoring Parameter, the sampling method, including the interval of time between successive samples, shall be appropriate...."**[27A58c]**

Response: The regulations have been changed in accordance with the wording suggested in this comment, except that the suggested portion "For each...Parameter, " has been eliminated to avoid redundancy because the wording of Subsection (e)(12) already contains this language.

Comment: Subsection (e)(12) should be eliminated because it is redundant to Subsection (e)(10). **[37W]**

Response: The regulations were not changed in response to this comment because this subsection provides a list of performance standards for proposed **sampling methods**, whereas Subsection (e)(10) addresses the method of determining the background concentration; therefore, Subsection (e)(12) is not redundant.

Comment: The phrase "with reasonable confidence" in Subsection (e)(12)(A) is not defined. **[37X]**

Response: The regulations were not changed in response to this comment because persons trained in statistical inference will have no problem understanding and applying this subsection consistently.

Subsection 2550.7(e)(13)

This subsection requires an accurate measurement of the ground water elevation and field parameters each time a well is sampled because this easily-acquired information provides valuable indications concerning conditions in the aquifer at the time of sampling. The ground water elevation information may be used as the basis for the ground water flow direction determination under Subsection (e)(15) in those quarters during which sampling is done, however, even if it is not so used, it also serves as a database which can be used for a retrospective analysis of the flow direction at the time of sampling in cases where the placement of the wells is in question. The requirement to obtain field parameters is retained from Subsection 2555(f) of repealed Article 5 because such data provides additional indications of conditions in the aquifer. The newly added "turbidity" field parameter is needed to an indication of the quality of installation and development of the well and to help assure that sample results have not been skewed by improper purging or sampling technique that causes fines to be entrained [i.e., constituents can adsorb to the fines and then be filtered out with those fines, thereby skewing the analysis].

Comment on Subsection 2550.7(e)(13)

Comment: This subsection requires the measurement of turbidity as part of the field parameters collected during ground water sampling. Waste Board staff believe that this field parameter is unnecessary for groundwater monitoring because most aquifers have low or no turbidity due, due to the filtering nature of soils, unless the wells were improperly designed or constructed. Turbidity is not a useful field parameter in ground water monitoring. **[68H{page 4}]**

Response: The regulations were not changed in response to this comment for the following reasons. Turbidity should be considered as one of the required field parameters because information regarding the amount of suspended solids in a sample at the time of sample collection is an important indicator of the reliability of the chemical results, of the completeness of well purging done prior to sampling, and of the effectiveness of well design and development. In addition, a sudden increase in the turbidity at a well helps to indicate a too-vigorous pumping rate during purging. It can also occur that a constituent of concern or monitoring parameter is adsorbed to the suspended solids, thereby biasing the results if the suspended solids are removed by filtration. It is inappropriate to ignore such important considerations in light of the fact that the turbidity of samples can be easily, quickly, and cheaply obtained in the field.

Subsection 2550.7(e)(14)

Subsection (e)(14) is retained in modified form from repealed Article 5 [Subsection 2555(g)], and essentially requires the discharger to graphically display monitoring data so that any new trends can be noted because (1) any unforeseen changes in background water quality can adversely impact the effectiveness of the monitoring program (2) visible inspection for trends in downgradient and background data is a viable, quick method for evaluating trends and seasonal fluctuations which may signal the need to revise the statistical method used. This requirement is to the advantage of both the discharger and the regional board because it helps to assure that the statistical methods used remains appropriate and that any plume of contamination proceeding toward the unit from an upgradient source will not cause the discharger's unit to be implicated.

Comments on Subsection 2550.7(e)(14):

Comment: The graph submission frequency under Subsection 2550.7(e)(14) should be stepped-up to quarterly. It is not clear that all analytical parameters should be graphed. The subsection should require any trends or changes in concentration between up- and down-gradient wells to be noted and discussed in the report accompanying the graphs. **[67J {pages: 25-26}]**

Response: The regulations were not changed in response to this comment for the following reasons. The constituents of concern may be analyzed as infrequently as every five years [Subsection 2550.8(g)] whereas the monitoring parameters are evaluated during each sampling episode [at least quarterly]; therefore, this subsection must be worded in a way which does not require constituents of concern that have not been monitored for some time to be continually re-displayed in the absence of new data. The wording requires the graphing of "all analytical data"; therefore, it includes all data from both constituents of concern (when appropriate) and from monitoring parameters. For example, if the constituents of concern have not been analyzed that year, then the discharger has already complied with this subsection by having submitted "all analytical data" on these constituents after they were last monitored; the wording provides that no new graphs on these constituents are required until there is new analytical data on them.

The requirement is for **at least annual** submission of the graphs; therefore, the regional board has the latitude to require more frequent submissions if it determines that this is appropriate. The comment provides no compelling argument in support of removing this discretion from the regional board.

Comment: Requiring that graphs of analytical data use only one monitoring point and parameter per graph is inappropriate because there are many instances in which combinations of monitoring points and/or constituents are more appropriately presented on the same page. This requirement would cause large facilities to create a considerable additional number of graphs. The requirement for twenty-four data points per graph appears to be an arbitrary standard. Large differences in concentration levels at monitoring locations may make it infeasible to plot all graphs for a given constituent at the same scale without loss of utility of some of the graphs [e.g., loss of the ability to detect trends]. **[63F,66C]**

Response: The regulations were changed in response to this comment by providing for the regional board to be able to grant permission for use of an alternative graphical display.

Subsection 2550.7(e)(15)

This subsection serves to assure that monitoring point well placement continues to be appropriate. This requirement is needed in order to verify that the wells used by the discharger are placed such that the screened interval in each well is likely to intercept a release emanating from the waste management unit. The local 3-dimensional flow field in the uppermost aquifer beneath a waste management unit often changes throughout the year due to the combined effects of pumping wells in the area, regional variations in recharge and/or discharge in the aquifer, and the effects of mounding beneath local recharge areas proximal to the unit. These and other factors can alter the local flow direction under the unit sufficiently that the monitoring wells are rendered useless because they are no longer situated along the flow path that a release would take. This requirement is included as assurance that the monitoring well network continues to provide a reliable indication of the presence, absence, or distribution of any release from the waste management unit. Changes in flow direction can occur at any time throughout the year. The requirement to check flow direction on a quarterly basis is retained from Subsection 2556(a)(4) of repealed Article 5 because there is no evidence at this time which would support a more frequent determination.

Comments on Subsection 2550.7(e)(15):

Comment: How is the "ground water flow rate" to be measured, as required in subsection (e)(15)? **[23P]**

Response: The regulations were not changed in response to this comment because the comment did not require a change. Ground water flow rate is normally estimated by multiplying the hydraulic conductivity of the formation by the local hydraulic gradient and then dividing the result by the mean porosity of the formation. The hydraulic conductivity and porosity are constants whose values should have been determined by the discharger while accumulating the hydrogeologic site information required in the initial Report of Waste Discharge under Section 2595 of this chapter, whereas the gradient is obtained by mapping the ground water elevations determined pursuant to this subsection.

Comment: For clarity, this subsection should begin as follows: "In addition to water quality sampling conducted pursuant to this article, the discharger shall measure...."**[27A58d]**

Response: The regulations have been changed in accordance with the wording suggested in this comment but the phrase "the requirements of" was added preceding the phrase "this article" in order to provide increased clarity.

Subsection 2550.7(e)(16)

This requirement is necessary to assure that all data produced will be available to the Regional Board for either periodic inspection or to serve as the basis for any needed investigation concerning the waste management unit.

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Section 2550.8. Detection Monitoring Program.

Specific Purpose

The specific purpose of this section is to protect human health and the environment by providing for a monitoring and response program capable of detecting a release from the waste management unit at the earliest possible time and, thereby, triggering an Evaluation Monitoring Program followed by a Corrective Action Program.

Factual Basis

Section 2550.8 is necessary because some means of analyzing water bodies must be employed in order to determine if wastes are degrading the water. This section is based on 40 CFR Section 264.98. It contains detailed requirements for a discharger implementing a Detection Monitoring Program. Although many changes have been made to the federal language to produce this section, most are reflections of the major changes described in the article overview. This section conforms to the corresponding federal regulation except for the general changes specified in the introduction to this Statement of Reasons and in the article overview and as described below. This section is necessary in order to provide both the discharger and the Regional Board with a delineation of the specific requirements which apply during a Detection Monitoring Program.

Comments on Section 2550.8

Comment: The revised regulations do not address the existing lab capacity and lab turnaround problems. It takes at least two months from the date of sampling to analyze, report, and review the results of the ground water data. Statistical tests may take longer, especially to review the results. It may be physically impossible to run statistics on data collected every six weeks at the end of the six-month period, especially if the monitoring programs get larger and more complex. The accelerated sampling schedule places an unrealistic burden on the regulated community. **[56H]**

Response: The regulations were not changed in response to this comment because the regulations require the data to be analyzed only after it has been returned by the laboratory; therefore,

normal delays in laboratory processing are not an impediment to compliance with the revised regulations.

Comment: The delay in starting corrective action that the "resampling program" provides should be eliminated [Subsections 2550.8(j) and (k)]; corrective action should be required to commence as soon as releases are detected and should stop only if resampling establishes a "false positive". **[46L]**

Response: The regulations were not changed in response to this comment because the commentor provides neither substantiation nor rationale for the change. The reasoning behind permitting the use of a retest, even in the face of a possible release, is adequately covered in the introduction to this Statement of Reasons and in the Factual Basis for Subsections 2550.7(e)(8)(E) and 2550.8(j) and (k) of this article.

Comment: Experience has shown that **any** detected release from a waste management unit can signal significant potential contamination problems. Thus to prevent costly delays cleanup caused by vague requirements and ignored releases, the regulations in Section 2550.8 should state that **any** detectable release of substances [i.e., monitoring results exceed either background levels or a standard minimum level (whichever is lower)] from the waste management unit should trigger a corrective action program. "The regulations should require the State Board to specify the standard minimum levels, which should take effect in the interim period during which the regional boards are exploring alternative, stricter background levels (thus avoiding implementation delays)." **[46F]** The article should be revised to require that the owner or operator of a landfill be required, subsequent to the discovery of a release, to initiate and complete cleanup of the ground water, including immediate, emergency containment actions. **[47D]**

Response: The regulations were not changed in response to this comment for the following reasons. Background concentrations typically vary around the mean of their distribution; therefore, it is not possible to pick a single value [i.e., the mean] and initiate corrective action measures each time a sample exceeds that value. For example, it would not be reasonable to require the discharger to initiate corrective action on the basis of a downgradient sample that exceeds the background mean when, by definition, approximately half of the background samples also exceed that mean. Once a release has been reliably indicated,

the revised regulations require the discharger to prepare for corrective action [i.e., proceed with an Evaluation Monitoring Program]. The regulations specify that during detection monitoring and during evaluation monitoring Concentration Limits shall be equal to the background concentration. Concentration Limits greater than background can only be proposed for use in corrective action in cases where the affected waters cannot be cleaned up to the background concentration and where such elevated cleanup concentrations will not pose a threat to human health or the environment. Subsection 2550.9(g) enables the regional board to prescribe interim corrective action measures in cases where the slight additional wait for the inception of the Corrective Action Program could itself constitute a threat to human health or the environment.

Comment: For clarity, Subsections (k)(1), (k)(2), and (n) of this section should indicate that the sampling must be done for all monitoring points at the waste management unit at which there was statistically significant evidence of a release. Without revision, these subsections would require the sampling to be done at all monitoring points at the unit or facility. This does not seem to be the intent of these subsections.**[27A60a]** For consistency with Subsection (k)(2), add to Subsection (k)(1) the phrase "in the affected medium (ground water, surface water, or the unsaturated zone)" after "monitoring points".**[27A60b]**

Response: The regulations have been changed as suggested in this comment and, in Subsection (n), language has been added to clarify that the requirements only apply to any medium [i.e., ground water, surface water, or the unsaturated zone] that was affected by the release from the waste management unit.

Comment: Subsections (j)(1), and (k)(1), (4), (5), and (6) of this section require various submittals from the discharger to the regional board. Notice should also be provided to the local enforcement agency and to the CIWMB.**[42W,68I{page 4}]** Water utilities, districts, or other agencies using ground water and surface water that could be impacted by leakage from a waste management unit should be provided with the quarterly monitoring reports that are provided to the regional board. These entities need to be given the opportunity to independently review data on the performance of containment systems in order to protect their local water resources and take appropriate action. This could lead to a process whereby those who would have the greatest

concern about ground water pollution by a waste management unit could be actively involved in reviewing such a unit, thereby providing greater assurance that ground water pollution problems will not go unattended. **[47B]**

Response: The regulations have not been changed in accordance with these comments because monitoring reports are public information; therefore, any citizen or entity may request a copy of such submittals to the regional board.

Subsection 2550.8(a)
This subsection is needed for clarity in establishing that the requirements of this section are not selectively applied.

Subsection 2550.8(b)
This subsection represents a nonsubstantial change from 40 CFR 264.98(b) with the following exceptions. The federal language only requires the discharger to install a ground water monitoring system at the point of compliance. It has been rewritten using the phrase "water quality monitoring systems" to emphasize the inclusion of the surface water and unsaturated zone monitoring systems as described in revised Section 2550.7. The reference in the federal language to the point of compliance has been dropped because Section 2550.7 more clearly specifies the types and locations of monitoring points which are required for each system. The references to 40 CFR Subsections 264.97(a)(2), (b), and (c) have been changed to reflect the structural changes which were made to Section 2550.7. This subsection is necessary to provide a clear back-reference to the general water quality monitoring requirements of Section 2550.7, applicable subsections of which must be complied with during a Detection Monitoring Program for the purpose of assuring that the monitoring systems will reliably detect a release from the waste management unit at the earliest possible moment.

Subsection 2550.8(c)
Revised subsection (c) represents a nonsubstantial change from 40 CFR 264.98(c). The revised subsection requires background values to be determined for each monitored constituent and parameter because reliable background values are a cornerstone of any monitoring program that is capable of providing a reliable indication of a release from the waste management unit. The referenced subsection [revised Subsection 2550.7(e)(11)] requires the discharger to integrate the background data with the proposed

statistical procedure to be used, thereby producing a background value that is appropriate for the fate and transport characteristics of the waste constituent, for the hydrogeologic environment underlying the unit, and for the statistical test the background data is to be used with. This requirement is necessary in a section on Detection Monitoring because many dischargers will not as yet have established background values in this manner prior to beginning this monitoring and response program. Without properly established background values the Detection Monitoring Program cannot be relied upon to achieve its overall objective of protecting human health and the environment through the reliable, early detection of a release from the unit.

Comments on Subsection 2550.8(c):

Comment: One commentor stated that the requirement to establish background values pursuant to this subsection "may pose a potential for problems."[13H]

Response: The regulations were not changed in response to this comment because the comment did not identify which aspect of this subsection could pose a problem and because careful review of the wording of this requirement did not reveal any such problem.

Comment: What is to prohibit a discharger from establishing a higher background concentration than is actually present in the water?[4G,20F]

Response: The regulations were not changed in response to this comment because the comment did not suggest any change. In answer to the question, however, the values turned in by the discharger that represent the background values of the Constituents of Concern and Monitoring Parameters are produced pursuant to Subsections 2550.7(e)(11) and (e)(10) of the revised article, a process that is under close Regional Board scrutiny. In addition, the distribution of the background data is used to help choose the best statistical method, pursuant to Subsection 2550.7(e)(7). It is extremely unlikely that the discharger would be able to successfully shepherd altered data through such a complicated, closely scrutinized process. In addition, there is nothing in these regulations which precludes the common Regional Board tactic of occasionally splitting samples with the discharger as a quality control measure.

Comment: For clarity, this subsection should read as follows: "The discharger shall establish a background value pursuant to Section 2550.7(e)(11) of this article for each Monitoring Parameter specified under Subsection (e) of this section, and for each Constituent of Concern specified under Subsection (d) of this section."**[27A58e]**

Response: The regulations have been changed as suggested in this comment, with the exception that the phrase "specified under Subsection (d) of this section" has been replaced with "under Section 2550.3 of this article". This minor modification was necessary because Subsection (d) of this section has been rewritten. The requirement to specify Constituents of Concern in the Waste Discharge Requirements is found in Section 2550.3.

Subsection 2550.8(d)

This subsection requires the Regional Board to specify the Water Quality Protection Standard [Standard] in the Waste Discharge Requirements for a Detection Monitoring Program so that a reliable, established standard of compliance exists against which the discharger and the Regional Board can measure the monitoring data. The Subpart F regulations (of 40 CFR Part 264) do not provide a Standard except during the compliance period after a release has been detected. As explained in the introduction to the Statement of Reasons for this article and in the Statement of Reasons for Section 2550.2, the Standard used in revised Article 5 is specified in both the Detection Monitoring Program and the Corrective Action Program in order to maximize the degree of protection afforded to human health and the environment, and to minimize the delay between the discovery of a release and the inception of a Corrective Action Program to address the release. In addition, this Standard applies to all monitored media, whereas, the federal Standard applies only to the ground water medium. The essential component parts of a Standard for use in a Detection Monitoring Program consist of: a list of the Constituents of Concern; a Concentration Limit for each Constituent of Concern in each monitored medium; a list of Monitoring Points at which the Standard applies and a description of the Point of Compliance; and a description of the duration of time over which the Standard applies. Section 2550.2 and the sections referenced therein contain provisions for creating a Standard which is especially adapted for use in a Detection Monitoring Program.

Constituents of Concern: The Constituents of Concern that the Regional Board has determined for the unit pursuant to Section 2550.3 of this article bring focus upon all chemicals that could conceivably be introduced into waters of the State as a result of a release from the waste management unit and which could impact human health or the environment.

Concentration Limits: Revised Section 2550.4 provides that for each Constituent of Concern the Standard for a Detection Monitoring Program should include a Concentration Limit equal to the background value of that constituent in each monitored medium [i.e., each monitored ground water body, each monitored surface water body, soil-pore liquid, and (for land treatment units) soil] because background is likely to differ considerably among these media for any given constituent. By having a background value established for each Constituent of Concern, there need be no delay for purposes of establishing background prior to initiating an Evaluation Monitoring Program as is the case under the federal approach.

Monitoring Points and the Compliance Point: A description of the compliance point and of all monitoring points in each monitored medium, pursuant to Section 2550.5, is necessary in order to clearly stipulate the locations where monitoring is to be conducted. The list of monitoring points is the list of those locations where the Standard is specifically applied. The Standard applies throughout all susceptible portions of the monitored media, however, monitoring at all such locations is not feasible, therefore, the monitoring points are those locations which can represent the conditions within each monitored medium.

Duration of Application of the Standard: For the purpose of clarity, the Standard includes the duration over which it will apply.

Comment on Subsection 2550.8(d):

Comment: For consistency with the definition of water quality protection standard in Section 2550.2, this paragraph should be reworded because the items described in Subsection (d)(4) are not part of the water quality protection standard as defined in Section 2550.2. Subsection (d)(4) should require that the compliance period be specified in the facility permit, and it should cite Section 2550.6 for the method for determining the

length of the compliance period.**[27A59a]** Subsection (d)(5) has this same problem, so should also be reworded.**[27A59b]**

Response: This comment, although not entirely accurate, identified a serious problem with the clarity of the proposed language. In response to this comment, the listed sub-components of the water quality protection standard under Subsection (d) have been deleted, because they are already listed clearly under Section 2550.2.

Subsection 2550.8(e)

Monitoring Parameters serve the purpose of providing an effective monitoring program while at the same time minimizing the incidence of Type I errors [false-positives]. This subsection requires the Regional Board to include a list of Monitoring Parameters in the permit and to require the discharger to use these Monitoring Parameters for the normal monitoring that is carried out at least twice yearly. The Monitoring Parameters for a Detection Monitoring Program constitute an abbreviated list of constituents or parameters that are chosen such that they act as a reliable surrogate for the more extensive list of Constituents of Concern. Because Type I error rate is directly proportional to the number of parameters monitored, the best list of Monitoring Parameters is the shortest one that will adequately represent the Constituents of Concern.

Subsection (e) contains a definition of the term "Monitoring Parameter". This definition is also proposed for inclusion in Section 2601 of Chapter 15. This definition is needed in both places for purposes of clarity.

Under Subsection 2550.7(e)(9)(B), the Type I error rate [false-positives] for comparing individual monitoring points with background is set at one percent. For a given waste management unit, this error rate is additive across all comparisons made, such that if 30 Monitoring Parameters are analyzed at five monitoring points twice yearly, then the waste management unit has a 300 percent chance of a false-positive each year. By reducing this list of Monitoring Parameters to 10 [for example], the yearly chance of having a false-positive would be reduced to 100 percent. When this lowered incidence of Type I errors is combined with the optional retest provided to the discharger under Subsection (j)(2) of this section, the combined effect is to greatly lessen the incidence of situations where a statistically-based error causes the discharger to initiate an

Evaluation Monitoring Program when there has been no release from the unit.

A carefully chosen list of Monitoring Parameters is just as likely to detect a release as if the Constituents of Concern were monitored directly, yet the incidence of false-positive determinations is kept within reasonable bounds. This approach affords a high degree of protection to human health and the environment while at the same time minimizing adverse fiscal impacts to the Regional Board and to the discharger resulting from false-positive determinations. It is likely that a different list of Monitoring Parameters will be needed for each medium monitored.

Subsections (e)(1) through (e)(5) list the considerations that the Regional Board will use in choosing the list of Monitoring Parameters. These considerations are necessary to insure that each Monitoring Parameter does its job well, and that there are enough Monitoring Parameters to fully represent all of the Constituents of Concern in the medium to which the Monitoring Parameter is going to be applied.

Comments on Subsection 2550.8(e):

Comment: The previous regulations required statistical analysis on only four parameters whereas California's revised regulations could require a far greater number of parameters (as seen in recently revised WDRs) of over 50 parameters. We agree with Dr. Gibbons that by chance alone, all sites will continuously fail the statistics for one of more of these parameters. **[56G]**

Response: The regulations were not changed in response to this comment for the following reasons. The repealed regulations, under Subsection 2556(a)(2) of this article, do not require a suite of only four parameters; the list is as long as it has to be to provide a reliable indication that a release has occurred. The revised regulations utilize this same approach under Subsection 2550.8(e). It is up to the discharger to propose the shortest list of monitoring parameters that will effectively indicate that a release has occurred.

Comment: The inclusion of the definition of the term "Monitoring Parameters" within the text of this subsection is redundant and a source of confusion. The term "Monitoring Parameters" should be used without any accompanying delineation. **[18AL,25AL]**

Response: The revised regulations were not changed in response to this comment for the following reason. The suite of Monitoring Parameters used under each monitoring and response program are likely to be different because the purpose of the Monitoring Parameter suite is different in each program. For this reason, it is necessary to both list the groups of parameters or constituent from which the Monitoring Parameters will be chosen [e.g., physical parameters, hazardous constituents, waste constituents, and reaction products] and list the service that the Monitoring Parameters must perform in that program [i.e., for detection monitoring, they must "provide a reliable indication of a release from the waste management unit."]. The use of a single term "Monitoring Parameters", as suggested by the commentor, would not convey these shades of meaning.

Comment: The term "physical parameter" used in this subsection should be provided with a definition to differentiate it from the term "indicator parameter" that is used throughout Subpart F of 40 CFR 264. **[27A59c]**

Response: In response to this comment, a definition of this term has been added to revised Article 10.

Subsection 2550.8(f)

For the purpose of providing clearly understandable requirements to the discharger, this subsection requires the Regional Board to include in the Waste Discharge Requirements the frequency for sample collection and statistical analysis relative to the Monitoring Parameters.

Comments on Subsection 2550.8(f):

Comment: Minimum standards in the revised regulations are often inadequate to protect water quality. For example, Subsection (f) sets a minimum requirement that samples be taken from each monitoring point only semi-annually. Sampling only every six months creates a substantial likelihood that releases will be missed and threats to water and soil contamination will be allowed to accumulate. **[46D]**

Response: The regulations were changed to modify and clarify the sampling frequency requirements. The timing/frequency requirements have been consolidated under Subsection 2550.7(e)(12). The minimum monitoring level required by the version of Article 5 adopted in 1984 was four samples per year [taken quarterly] and quarterly statistical analysis. This approach has been retained in the revised article except in instances where four or more samples are taken every six months, in which case statistics may be carried out no less frequently than once every six months.

Comment: Subsection (f) should include time frames for analysis of quality assurance/quality control [QA/QC]. **[42T]**

Response: The regulations were not changed in response to this comment because this subsection has no reference to QA/QC; therefore, staff is unable to understand the comment. In any event, doing what the comment suggests is not feasible because the scope of this rulemaking does not include the promulgation of detailed requirements for QA/QC.

Comment: Insert the phrase "in Waste Discharge Requirements" after the phrase "The regional board shall specify". **[37Y]**

Response: The regulations were not changed in response to this comment because the regional board should have the option of placing such details in either the Waste Discharge Requirements themselves or in a sampling and analysis appendix to them. The requirement that the regional board specify the frequencies is sufficiently explicit in this instance.

Subsection 2550.8(g)

This subsection requires occasional monitoring of the Constituents of Concern in order to validate the effectiveness of the Monitoring Parameters. Most of the monitoring that is done in a Detection Monitoring Program focuses on the Monitoring Parameters selected for each individual program. This assumes that these parameters will indicate the presence or absence of the Constituents of Concern which constitute the actual threat to water quality. However, to ensure that Constituents of Concern are not entering the water and failing to trigger an indication among the Monitoring Parameters, it is necessary to validate the Monitoring Parameters by periodically monitoring directly for the

presence of Constituents of Concern. The Monitoring Parameter approach is used because it is not practical to monitor for all Constituents of Concern on a frequent basis because the greater number of parameters relative to that for the Monitoring Parameters would result in both unnecessary expense and an unacceptable incidence of Type I errors [i.e., false indications of a release]. Subsection (g) addresses this problem by requiring the discharger to monitor for all Constituents of Concern at a frequency determined by the Regional Board for the purpose of validating that the Monitoring Parameters are effectively representing the Constituents of Concern. The Regional Board will specify this frequency in the Waste Discharge Requirements. A maximum interval of five years is set between such validation sampling efforts because a longer maximum interval would constitute an unacceptable risk in cases where the Monitoring Parameters become unreliable soon after a validation sampling. The five-year maximum interval strikes a reasonable balance between the risk of unreliability of the Monitoring Parameters and the expense associated with validating those Monitoring Parameters.

If this periodic monitoring effort indicates that a Constituent of Concern exceeds its respective concentration limit by a statistically significant amount, this is evidence that the Monitoring Parameters are not performing properly and also that the Standard is exceeded. If the Standard is exceeded, the suite of Monitoring Parameters will be modified for use in the Evaluation Monitoring Program. If there is any lack of correlation between the Constituents of Concern and the Monitoring Parameters, then the Monitoring Parameters for detection monitoring should be modified correspondingly.

The use of Monitoring Parameters for general monitoring provides a much more cost-effective monitoring approach than does monitoring directly for the Constituents of Concern, however, this approach is protective of human health and the environment only so long as the Monitoring Parameters continue to effectively represent the Constituents of Concern. This requirement is necessary in order to assure that the Monitoring Parameters are doing this essential job effectively.

Comments on Subsection 2550.8(g):

Comment: The prescriptive monitoring requirement to validate the list of Constituents of Concern at least every five years is arbitrary and unnecessary based on the Statement of Reasons. **[42V]**

Response: The regulations were not changed in response to this comment because the factual basis for Subsection 2550.8(g) in this Statement of Reasons provides an adequate support of the five-year minimum validation period. To monitor all Constituents of Concern at each monitoring effort would be unreasonably expensive if a set of Monitoring Parameters are available which will reliably indicate a release. It would be imprudent, given the complexity of ground water monitoring, to rely indefinitely upon the Monitoring Parameters. Therefore, in our professional judgement, all Constituents of Concern should be monitored to verify the validity of the suite of Monitoring Parameters at least every five years.

Comment: Subsection (g) is confusing because its wording seems to imply that any breaching of the water quality protection standard is to be considered a release, even if this is not supported by the required statistical analysis. **[23Q]** This subsection makes the assumption that non-compliance is statistically significant evidence of a release from the waste management unit -- an assumption that may not be correct. Adjacent or upgradient sources may be responsible for the contamination, or poor QA/QC procedures may be to blame. Operators should be given a formal chance to explain mitigating circumstances. **[42U]**

Response: In response to these comments, the wording of Subsection (g) has been changed to clarify that a statistically significant difference for a Constituent of Concern is one of the means by which the water quality protection standard is deemed to have been exceeded. No other changes were necessary for the following reasons. In order to eliminate the incidence of false indications of a release, the discharger whose unit has just indicated a release has the following two alternatives to proceeding forward immediately with an Evaluation Monitoring Program. Subsection 2550.8(k)(7) permits the discharger to demonstrate the indication of the release due to error. Subsection 2550.8(j)(2) permits the discharger to initiate an approved retest procedure in cases where no error can be detected. When an indication of a release cannot be successfully addressed by either of these two options, then there is indeed a good reason to investigate the source of the problem via an Evaluation Monitoring Program. If the Evaluation Monitoring Program shows that the unit is not at fault, then Subsection 2550.9(f) provides an avenue for the discharger to return to a Detection Monitoring Program.

Comment: It is not necessary to monitor for Constituents of Concern until after a release because the Monitoring Parameters used in detection monitoring are chosen based upon their ability to provide a reliable indication of a release from the waste management unit. **[18AQ,25AQ]**

Response: The regulations were not changed in response to this comment for the following reasons. The Monitoring Parameters used in detection monitoring are intended to serve as good indicators of a release and are chosen with this goal in mind, however, this choice is typically not made on the basis of previous experience with a release at that unit. Therefore, the possibility remains that a release has occurred which has not been detected through the use of the Monitoring Parameters. Therefore, the validity of the chosen Monitoring Parameters needs to be tested at intervals chosen by the regional board, based upon the regional board's confidence that the smaller suite of Monitoring Parameters do indeed serve as a competent surrogate for the more numerous Constituents of Concern. The good intentions with which the Monitoring Parameters are originally chosen cannot displace the need to validate those choices.

Comment: The amount of monitoring required by the revised regulations for purposes of statistical validation of monitoring systems is unnecessarily extensive. This validation could be adequately handled by checking a subset of the monitoring points rather than all of them. **[30H,30R,30Z,36AC]**

Response: The regulations have been changed in response to this comment by enabling the regional board to stipulate which monitoring points are to be used in the validation process. In this way, site-specific conditions can be taken into account to optimize the number and location of the monitoring points used in validating that the Monitoring Parameters are acting as an effective surrogate for the Constituents of Concern.

Subsection 2550.8(h)

This subsection is necessary to ensure that all monitoring data is recorded and is available to the regional board and that all data is organized in a manner that facilitates analysis according to the statistical methodology approved for that constituent.

Comments on Subsection 2550.8(h):

Comment: For consistency with the citation of Subsection (e)(12), this subsection should begin "The discharger shall conduct sampling for each Monitoring Parameter....", because sampling is the one aspect of water quality monitoring which is addressed in that citation. **[27A59d]**

Response: This comment correctly identified an inconsistency in the revised regulations, therefore, after review this requirement has been modified and moved to Subsection (f) of this section and the reference to Subsection 2550.7(e)(12) has been deleted.

Subsection 2550.8(i)

The requirements under this subsection control the manner in which Monitoring Parameters are used to determine the presence of a release from the waste management unit in order to assure that the discharger uses for each Monitoring Parameter only the statistical procedure that is assigned to that parameter; that the analysis is carried out properly; and that the results are sent to the regional board within a reasonable period of time.

In order to provide the discharger with an explicitly required response in cases where the regional board suspects that a release has occurred, Subsection (i)(3) stipulates that the regional board may at any time conduct a statistical analysis on its own, and that if the results of such a regional board analysis indicate that the Standard has been violated, then the discharger shall proceed in like manner to having made such a determination his/herself.

Comments on Subsection 2550.8(i):

Comment: The language in Subsection (i)(3) should restrict the regional board to using the same statistical method that has been included in the Waste Discharge Requirements. **[18AU,25AU,36AD]**

Response: The regulations were not changed in response to this comment because the regional board should have the freedom to investigate the possibility of a release using whatever methods it deems most appropriate for that purpose. Should the regional board utilize a statistical method which the discharger finds patently inappropriate, the discharger has recourse to various

means of redressing the perceived grievance, including State Board appeals and through court action. Although it would be rather unusual if the regional board were to use a statistical method other than that which it has approved for use by the discharger, there remain conditions under which it would be imprudent to restrict the regional board in its free choice of method. For example, conditions can change at the site, or an ongoing long term change could be noticed which would invalidate the results of the approved statistical method or make it less sensitive than another method that is more in accord with the changed [or changing] conditions.

Subsection 2550.8(j)

In order to provide an expeditious response to a release from the waste management unit, this subsection stipulates the requirements and options that apply to a discharger in instances where there is statistically significant evidence of a release from the unit.

The nature of monitoring networks is such that the cost of installation and especially of ongoing sampling precludes having dense arrays of monitoring points. Typically, there will be just enough monitoring points that, if they are properly located, a release from the unit will be reliably detected. This means that a monitoring point will seldom be impacted by the most concentrated portion of a plume but will instead pick up the edge of the plume, resulting in only small changes in the concentrations of Constituents of Concern. Even in those instances where the plume is heading directly toward the monitoring point, the first indications of contamination will be small. It is, therefore, essential that all indications of a release be properly investigated in order to minimize the risk to human health and the environment. This subsection is necessary in order to provide the discharger with a means of control over Type I errors [false-positive indications of a release] while at the same time avoiding unnecessary delays in the event that an actual release has occurred.

In order to assure open channels of communication relative to violations of the Standard, Subsection (j)(1) requires the discharger to immediately notify the regional board verbally and to follow that up with written notification [by certified mail] within seven days of determining that a significant increase is indicated and also requires identification of the parameter or constituent that produced the indication. The provisions under

this subsection are necessary even if the discharger plans to resample under Subsection (j)(2) because any indication of a release represents a potential threat to human health and the environment and the regional board should be made aware of any such situation. The need for immediate verbal notification is to enable regional board staff to have enough notification to be able to attend the resampling event, if staff so desires.

In order to reduce the number of incidences in which Type I errors in which a statistical analysis moves the discharger into an Evaluation Monitoring Program when a release has not in fact occurred, Subsection (j)(2) provides the discharger the option of resampling for the indicating constituent or parameter at the monitoring point at which the release is indicated. However, a retest is only allowed if the retest procedure is approved by the regional board and included in Waste Discharge Requirements because conditions under which a release is indicated dictate both an expeditious resolution and a reliable, well thought out methodology.

Comment on Subsection 2550.8(j)

Comment: Subsection 2550.8(j) seems to allow the discharger the discretion of deciding whether or not a release is indicated, thereby allowing the discharger the freedom to ignore indications of a release. A provision for punitive action should be included to address those cases where the regional board is not notified at the time that a release is indicated. **[67K {page 26}]**

Response: The regulations were not changed in response to this comment because the purpose of this subsection is to make the discharger responsible for reporting indications of a release and punishable for not doing so. Contrary to this comment, the discharger is allowed very little leeway in the "determination" because it is a function of whether or not the statistical tests under Subsections (g) or (i) have indicated a release.

Subsection 2550.8(k)

The potential threat to human health and the environment posed by a release from a waste management unit necessitates rapid progress toward the implementation of an Evaluation Monitoring Program. The requirements under Subsection (k) accomplish this by providing a prearranged, deadline-controlled schedule of required actions by the discharger.

Subsection (k)(1) requires the discharger to determine the concentration of each Constituent of Concern at each monitoring point in the affected medium because it is important to know the current concentration of all Constituents of Concern at all potentially affected monitoring points in order for the discharger to formulate and propose an appropriate Evaluation Monitoring Program.

In order to assure that the list of Constituents of Concern is complete at a Class I unit, Subsection (k)(2) requires the discharger to analyze for Appendix IX constituents at all monitoring points in the affected medium. This represents a change from the federal requirement [40 CFR 264.98(g)(2)] to analyze all compliance point wells for Appendix IX constituents if any compliance point well indicates that a release has occurred. An expansion of the federal requirement to require Appendix IX analyses at all monitoring points in all media is not warranted because: (1) repealed California regulations do not clearly require that all monitoring points be sampled for Appendix IX constituents [Subsection 2557(e) of repealed Article 5]; (2) obtaining a sufficient volume of liquid from the unsaturated zone [for an Appendix IX analysis] would often be extremely difficult and, therefore, should only be required where a release has been indicated in that medium; and (3) intensified surface water sampling for Appendix IX constituents may not always be justified unless that medium has been affected by the release because surface water bodies are typically further removed from a unit than are the unsaturated zone and ground water media. An up-to-date list of the Constituents of Concern is needed in order to develop an effective Evaluation Monitoring Program.

For Class I units, Subsection (k)(3) requires that any Appendix IX constituents found pursuant to Subsection (k)(2) or through a reanalysis, as permitted in this subsection, will be added to the list of Constituents of Concern for use in the Evaluation Monitoring Program, unless the constituent is present in background in comparable concentrations, because the Constituent of Concern list is intended to address all constituents in or derived from the release. This subsection is necessary to clarify the intent and purpose of the Appendix IX analyses and to provide the discharger with the option of checking the validity of the initial analysis.

For a Class I unit, Subsection (k)(4) requires the discharger to develop a background data base and propose an appropriate statistical methodology to address each hazardous constituent

that is newly added to the list of Constituent of Concern pursuant to Subsection (k)(3) because it will be important to have the capability of reliably testing for these constituents during evaluation and corrective action.

In order to initiate an evaluation of the nature and extent of the release as soon as possible subsequent to the indication of a release, Subsection (k)(5) requires the discharger to submit a revised report of waste discharge to establish an Evaluation Monitoring Program to address that release. The requirements under this subsection are in accordance with federal and State regulatory requirements [40 CFR 264.98(g)(4) and Subsection 2556(b)(2) of repealed Article 5, respectively] and are needed to provide specific guidance concerning the nature and timing of the required submittal. Until an Evaluation Monitoring Program has been completed to address an indicated release, the nature and extent of that release cannot be known. Therefore, the degree of threat the release poses to human health and the environment also remains unknown. For example, it is quite possible that the release has eluded detection by passing between two monitoring points; therefore, it could extend downgradient for a considerable distance and be affecting water users. Such a potential threat can only be effectively managed on the basis of extensive knowledge. It is necessary, therefore, to expedite the initiation of a program designed to attain that knowledge. This subsection is necessary to facilitate an orderly, rapid transition into an Evaluation Monitoring Program by requiring the Report of Waste Discharge to include initial data concerning the release as well as plans for how best to evaluate the nature and extent of the release.

Subsection (k)(6) describes the essential elements of an engineering feasibility study. In order to prepare a Corrective Action Program that will work, the discharger must plan and propose a suite of corrective action measures that the discharger feels will be able to work effectively in cleaning up the release under the specific hydrogeologic conditions present beneath the waste management unit. Undue delay subsequent to the discovery of a release from the waste management unit serves no purpose but to increase the size of both the release, its impact upon human health and the environment, and the cost of remediation. The goal of any corrective action should be to clean up the release to the greatest extent feasible. Therefore, if the discharger is seeking a concentration limit greater than background [i.e., an incomplete cleanup] for any Constituent of Concern, then the engineering feasibility study must include a full justification for the proposed limit. The requirements of this subsection are

necessary to insure the timely development of an initial suite of corrective action options and to guarantee the timely submittal of the proposal to the regional board.

Subsection (k)(7) provides an option to the discharger who feels that the statistically significant increase that has been indicated is not a result of a release from the waste management unit. In those cases where the apparent release did not in fact emanate from the unit, it is to the advantage of both the discharger and the regional board to focus upon the actual cause of the problem rather than to expend resources needlessly. However, in cases where a release has actually occurred, it is important to avoid long delays in developing and implementing an Evaluation Monitoring Program because such delay permits a threat of unknown magnitude to continue to develop. The provisions of these subsections strike a balance between these two opposing considerations such that the discharger is permitted to attempt making such a demonstration, but the demonstration is not allowed to overly delay the development of an appropriate Evaluation Monitoring Program.

Comments on Subsection 2550.8(k):

Comment: The monitoring of "background monitoring points" was dropped for verification of a release of waste constituents. Waste Board staff believes that the collection of groundwater monitoring data without proper background data to compare against is a useless exercise. Only by comparing values obtained from monitoring wells with those obtained from background wells can the escape of waste constituents be confirmed. **[68J{page 5}]**

Response: The regulations were not changed in response to this comment for the following reasons. This subsection applies only to Class I units that have an indication of a release and requires that an Appendix IX analysis be carried out so see if there are any new constituents. This is not a comparison with background; therefore, no background samples need be taken. If the discharger finds an Appendix IX constituent in the water (that is not as yet a constituent of concern), then the discharger has the **option** of attempting to demonstrate that the constituent exists in the background water in comparable concentrations to that it exhibits in the downgradient wells. Lacking such a demonstration, the "new" constituent is added to the constituents of concern and the discharger is responsible for cleanup of that constituent during Corrective Action. Note that if the downgradient wells show no new Appendix IX constituents,

then the roughly $14,000 per sample spent on Appendix IX analyses at each background well is wasted because there is no need to use it for a demonstration. Therefore, there is no need to force the discharger to do Appendix IX analyses on samples from the background well because such sampling and analysis is effectively implemented by the discharger whenever appropriate.

Comment: Subsections (k)(1) and (k)(2) should provide the regional board the latitude to require the discharger to sample only those monitoring points stipulated by the regional board, because in many hydrogeologic settings it is not necessary to sample all monitoring points in order to protect human health and the environment. **[18AV,25AV,36AE]**

Response: The regulations were changed in response to this comment by providing that the discharger sample only the monitoring points in the affected medium. However, provision was not made to exclude any of the affected medium's monitoring points from this analysis because such an approach would only be viable if the fate and transport characteristics of a release were fully known prior to the release's nature and extent being delineated in an evaluation monitoring program. Given the lack of knowledge concerning the release just after its discovery in a detection monitoring program, it is necessary for the protection of human health and the environment that a detailed analysis be carried out on samples from every monitoring point in the medium in which the release has been indicated. The information gleaned from this media-wide analysis also serves as the basis for the discharger's proposed evaluation monitoring network.

Comment: In Subsection (k)(3) strike the last sentence and insert "or the discharger does not resample for the constituents found pursuant to Subsection (k)(2) of this section," after "If the results of the second analysis confirm the initial results,". **[37Z]**

Response: The regulations were changed in response to this comment, but in a different manner than that suggested by the commentor because the suggested language does not clearly address the situation in which a resampling effort is undertaken and only a portion of the initially detected constituents are validated by the retest.

Comment: For clarity, the second sentence of Subsection (k)(3) should be revised to make it clear that only those hazardous constituents which are detected in both sampling events must be added to the list of Constituents of Concern. For consistency, replace "water quality protection standard" with "Waste Discharge Requirements" in the second and third sentences of this subsection. **[27A60c]**

Response: The regulations have been changed in accordance with this comment.

Comment: A release does not necessarily mean a threat. For example, the release of tannic acid from a woodwaste pile is seldom a problem even if it does exceed the background concentration, therefore, the automatic requirement to prepare for an evaluation monitoring program [Subsection (k)(5)] or a corrective action program [Subsection (k)(6)] will not always be appropriate at waste management units handling non-hazardous waste. The submission of a demonstration pursuant to Subsection (k)(7) should be sufficient to forestall the transition to other programs. **[23R]**

Response: The regulations were not changed in response to this comment for the following reasons. The submission of a successful demonstration, pursuant to Subsection (k)(7), will keep the discharger from proceeding on to other programs. However, it is not protective of human health and the environment to permit the discharger's submitted report to delay the transition to another program if the report fails to satisfy the regional board that the release was erroneously indicated. In addition, all classified waste management units have been given their classification based on the potential for the wastes contained therein to adversely affect human health or the environment. Therefore, any release from a waste management unit, regardless of its classification, should be investigated and the appropriate corrective action measures implemented.

Comment: Subsection (k)(7) should clearly state that the engineering feasibility study required pursuant to Subsection (k)(6) is not required in cases where the discharger has submitted a demonstration under Subsection (k)(7). **[18BD,25BD,36AE]**

Response: The regulations have been changed in response to this comment to relieve the discharger that has made a successful

demonstration under Subsection (k)(7) from having to submit either an amended Report of Waste Discharge or an engineering feasibility study.

Comment: In Subsection (k)(7) make the following changes to the second sentence: strike the phrase "discharger may make a demonstration...; however, the"; strike the word "not" in the phrase "discharger is not relieved", and; replace the word "unless" in the phrase "unless the demonstration made" with the word "if". **[37AA]**

Response: The regulations were not changed in response to this comment because the suggested language only addresses what the discharger is responsible for in case the demonstration **is** successful, but is not specific concerning the required action in case the demonstration **is not** accepted. The existing draft language addresses both of these contingencies.

Comment: For clarity and consistency, Subsection (k)(7) should be revised as follows: in the first sentence, replace "contamination" with "evidence of a release", replace "detection" with "evidence", and insert "by" before the word "natural"; in the second sentence, replace "indication" with "evidence" in two places.**[27A60d]** For consistency with the first sentence of Subsection (k)(7), add the phrase "or from natural variation in the ground water, surface water or the unsaturated zone" to the end of the second sentence in Subsection (k)(7) and to the end of the Subsection (k)(7)(B).**[27A60e]** For consistency, replace "contamination" with "evidence" in both places it occurs in Subsection (k)(7)(B).**[27A61a]**

Response: The regulations have been changed in accordance with the suggestions in this comment.

Comment: Subsection (k)(5) should be changed to extend the schedule for the report of waste discharge or to delete the requirement to submit Appendix IX data with the report and require a separate submittal.**[56T]**

Response: The regulations were not changed in response to this comment because these requirements are consistent with the federal requirements under 40 CFR 264 Subpart F and must be included to maintain consistency with those regulations, pursuant to Subsection 13172(d) of the Water Code.

Comment: The wording in subsection 2550.8(k)(6) should be changed to read "...shall contain a detailed description of the corrective action measures that could be taken to achieve background or other relevant concentration limits pursuant to subsection 2550.4(c) for all constituents of concern;..." **[56U]**

Response: The regulations were not changed in response to this comment because before a concentration limit greater than background (CLGB) can be established the discharger must first propose and substantiate the reason for the CLGB. Such substantiation is not appropriate until the nature and extent of the release has been determined through evaluation monitoring.

Subsection 2550.8(l)

This subsection requires the discharger to request a change in the Waste Discharge Requirements any time the discharger perceives that the Detection Monitoring Program is failing to meet the requirements of this section, because the discharger is intimately involved with the waste management unit. Either the discharger or the discharger's staff will be aware of the day-to-day changes at the unit. The regional board does not have this advantage, therefore, this subsection is necessary to make the regional board aware of any problems with the program that are obvious only to the discharger. The discharger is required within 90 days of such determination to submit an amended report of waste discharge describing the perceived inadequacies in the program and listing proposed changes that will address the problem.

Subsection 2550.8(m)

This subsection is retained in modified form from Subsection 2556(c) of repealed Article 5 in order to clarify the specific manner by which a program deficiency perceived by the regional board is to be transmitted to the discharger, to declare the nature and timing of the response required of the discharger under such circumstances, and to avoid unnecessary delays in addressing program deficiencies. This requirement is essential because program deficiencies can result in inadequate protection of human health or the environment.

Subsection 2550.8(n)

Subsection (n) lists the special differences for Class I units between a typical Detection Monitoring Program and one which is taking place after the successful completion of a Corrective

Action Program. These requirements are necessary in order to retain the special monitoring provisions required [for Class I units] during the compliance period by the federal regulations.

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Section 2550.9. Evaluation Monitoring Program.

Specific Purpose

The specific purpose of this section is to protect human health and the environment by providing for a monitoring and response program that requires the expeditious delineation of the nature and extent of a release from a waste management unit and requires the development of corrective action measures capable of bringing the affected waters back into compliance with the Water Quality Protection Standard [Standard].

Factual Basis

This section represents a nonsubstantial change from Section 2557 of repealed Article 5. No concentration limits greater than background may be granted during the Evaluation Monitoring Program because such an approach could cause a delay in the inception of a Corrective Action Program. Therefore, concentration limits greater than the background concentration are only permitted under this revised article as clean-up concentrations during a Corrective Action Program. The Evaluation Monitoring Program is a necessary transition step between the Detection Monitoring Program and the Corrective Action Program because effective corrective action measures cannot be planned without the knowledge gained of the release during the Evaluation Monitoring Program. The discharger will be in the Evaluation Monitoring Program only for as long as necessary to evaluate the release and plan an effective Corrective Action Program because the longer a release remains uncorrected the greater the likelihood that human health and the environment will be adversely impacted. Therefore, the emphasis of the Evaluation Monitoring Program is the timely formulation of corrective action measures which will be effective in eliminating the threat posed by the release.

Comments on Section 2550.9:

Comment: Many of the provisions of this section are more appropriate at hazardous waste facilities as described in the Statement of Reasons. In addition, it is not clear how "evaluation" monitoring compares to the previous "verification" monitoring and the federal "compliance" monitoring.**[42X]**

Response: The regulations were not changed in response to this comment for the following reasons. Contrary to the commentor's inference, the Statement of Reasons for this section only mentions Class I units when addressing those few subsections in which additional action is required for such units. The introduction to this Statement of Reasons thoroughly compares and contrasts the various programs under repealed Article 5, revised Article 5, and existing 40 CFR Part 264 Subpart F.

Comment: By only monitoring regularly for certain parameters rather than the full list of Constituents of Concern, it seems possible that the waters of the State will be subjected to increased risk of contamination. **[3B]**

Response: The regulations were not changed in response to this comment for the following reasons. As the commentor observed, Subsection (e)(3) of this section requires an ongoing monitoring effort centering around a list of Monitoring Parameters. This regular monitoring, however, is intended only to supplement the constituent-specific three-dimensional plume delineation effort that the discharger is carrying out under Subsection (b) of this section and which is the primary focus of the Evaluation Monitoring Program. Under Subsection (b), the discharger must carry out whatever efforts are necessary to complete the plume delineation within 90 days of beginning the evaluation monitoring. The combination of normal monitoring for Monitoring Parameters under Subsection (e)(3) combined with the strenuous delineation effort required pursuant to Subsection (b) provides a very thorough basis for creating a workable corrective action plan in the shortest possible time span. No additional monitoring should be necessary.

Comment: Time frames should be specified for the activities required in Subsections 2550.9(b), (c), and (d). Under 40 CFR 264.99(h)(2) the discharger is required to submit an application for permit modification to establish a corrective action program within 180 days (or within 90 days if an engineering feasibility study has been previously submitted) of exceeding the ground water protection standard in the compliance monitoring program. Although in revised Article 5 the waste management unit is put on the corrective action track when the water quality protection standard is exceeded in detection monitoring, there is no set time frame for the discharger to submit the amended Report of Waste Discharge for corrective action. Therefore, there is the potential for the

discharger to submit the application later under revised Article 5 than under the federal regulations, unless a time frame at least as stringent as that required by the federal regulations is added to the revised article. Since the discharger has already submitted an engineering feasibility study in detection monitoring under Subsection 2550.8(k)(6), revised Article 5 should require the subsequent submittal of an amended Report of Waste Discharge to establish a corrective action program within 90 days of establishing an evaluation monitoring program. **[27A139]**

Response: Subsections 2550.9(b), (c), and (d) have been changed in accordance with this comment.

Comment: The wording "according to a schedule established by the regional board" should be added (as it was in the previous draft) to the requirements pursuant to establishing an evaluation monitoring program. **[56V]**

Response: The regulations were not changed in response to this comment because the 90-day schedule is required by Region IX of EPA and is necessary for consistency with the federal regulations under 40 CFR 264 Subpart F. Such consistency is required of the State Board regulations under Subsection 13172(d) of the Water Code.

Comment: Revised Subsections 2550.9(d), (h), and (i) require the submission of an "amended Report of Waste Discharge" [amended ROWD]. It is not clear if this submission should be accompanied by a filing fee. **[37E]**

Response: The regulations were not changed in response to this comment because by the time the revised article is promulgated, the fee system for submitting and updating ROWDs will have changed over to an annual fee basis that does not depend upon the frequency of submission of the ROWD. Therefore, there will be no confusion in implementing this requirement.

Subsection 2550.9(a)

For purposes of clarity, Subsection (a) states that all the requirements of Section 2550.9 apply to a discharger that is required to establish a Evaluation Monitoring Program and that the focus of the program is to evaluate the nature and extent of the release in an expeditious manner.

Comment on Subsection 2550.9(a):

Comment: This subsection should require that the water quality protection standard be specified or updated for the evaluation monitoring program. The four aspects of the water quality protection standard are involved: the list of Constituents of Concern; their concentration limits; the compliance point; and the compliance period. USEPA recognizes that it is implied throughout the revised Article 5 regulations that concentration limits greater than background do not apply during evaluation monitoring [e.g., see Subsection 2550.4(h), and the comment on that section]. Since 40 CFR 264 Subpart F allows the use of alternate concentration limits during compliance monitoring, revised Article 5 is more stringent than Subpart F in this respect. However, it is important that the concentration limits greater than background be specified in the Waste Discharge Requirements, as modified for evaluation monitoring, even though they will not apply during evaluation monitoring. This is because revised Article 5, like Subpart F, requires that during a corrective action program, the discharger ensure that the waste management unit achieve compliance with the water quality protection standard [see Subsection 2550.10(b)]. If the regional board has not specified the concentration limits greater than background [e.g., in the Waste Discharge Requirements] before the proposed corrective action program is due from the discharger, the discharger will not be able to propose a meaningful corrective action program: the discharger will not know which of his proposed concentration limits greater than background have been approved, an so will not know which hazardous constituents to address, and will not know which concentration limits the clean-up must meet. Therefore, it is important that the water quality protection standard is updated in the evaluation monitoring program with the approved concentration limits greater than background. It is also necessary to update the list of Constituents of Concern when amending the Waste Discharge Requirements for evaluation monitoring. The Appendix IX sampling required by Subsection 2550.8(k)(2) will potentially augment the list of Constituents of Concern by identifying hazardous constituents in the ground water which had not been anticipated in the list of Constituents of Concern established for the detection monitoring program under Subsection 2550.8(d)(1). Finally, the compliance point and the compliance period apply during the evaluation monitoring program, and although they have already been established during the detection monitoring program, and will normally be the same during the evaluation monitoring

program, they should be restated when the Waste Discharge Requirements are amended for evaluation monitoring.**[27A137]**

Response: The changes proposed in this comment have not been incorporated into the revised regulations for the following reasons.

The State Board's regulation writers consider it unwise to approve cleanup concentrations before the nature and extent of contamination have been determined.

Revised Section 2550.2 applies under all programs, and requires that the water quality protection standard be specified in the Waste Discharge Requirements. It is not necessary to repeat that requirement for an evaluation monitoring program.

The concern, expressed in this comment, that a discharger will not be able to prepare an effective corrective action program until clean-up concentrations are established is a valid concern. On the other hand, it is inappropriate to establish these limits prematurely. It is reasonable to expect that any facility that is preparing for a corrective action program for one of its units will be in frequent communication during the evaluation monitoring program with the regional board staff person in charge of that site. Waste Discharge Requirement conditions are also subject to public review prior to adoption or revision and through the California Environmental Quality Act [CEQA]. In addition, the discharger can look to the criteria for establishing concentration limits greater than background as effective predictors of what the regional board can approve. For example:

1) A discharger must expect to be required to clean-up to background concentrations whenever it is technologically and economically feasible to do so [Subsection 2550.4(c)]; and

2) For constituents with health or environmentally based standards promulgated by the Department of Health Services or by USEPA, the concentration limit may not exceed the health based standard [Subsection 2550.4(e)(1)].

USEPA has expressed concern that initiation of corrective action could be delayed by repeated unsuccessful attempt to obtain concentration limits greater than background. In response to that concern, the revised regulations have been modified to include a requirement that the engineering feasibility study must contain, at a minimum, a detailed description of the corrective

action measures that could be taken to achieve background concentrations for all Constituents of Concern. Since this same information will be needed as part of the justification for a concentration limit greater than background, this new requirement satisfies USEPA's concern about undue delays without adding an unreasonable burden to the discharger.

Subsection 2550.9(b)

In order to assure timely preparation of appropriate corrective action measures, Subsection (b) requires the discharger to do whatever is necessary to delineate the nature and extent of the release in accordance with the schedule of compliance established by the regional board.

It is not possible to foresee all the locations where monitoring points will be required for the delineation of a release, therefore, this subsection does not require that the delineation be accomplished solely through the use of monitoring points. The regional board will approve a workable monitoring point layout proposed by the discharger for this program. However, this initial layout can, of necessity, only be a first approximation which will then be refined through successive approximations involving the installation of monitoring locations additional to those originally listed in the Waste Discharge Requirements for use in this program. Much useful information will be derived from the monitoring points established in the Waste Discharge Requirements, however, the majority of the plume delineation will probably be derived from monitoring locations installed by the discharger for plume delineation [e.g., assessment wells] and which are not listed in the Waste Discharge Requirements. In addition, the twice-yearly analysis approach typically used at listed monitoring points is too slow to provide all necessary plume delineation data within the 90 day time line. This subsection is necessary in order to provide regional board control over those monitoring locations not included in the sanctioned monitoring point layout by requiring the discharger to accomplish, by whatever means necessary, a full delineation of the release within 90 days of determining the presence of a release.

This subsection is a necessary performance standard because enlightened stewardship of human health and the environment mandates an expeditious delineation of the release so that a well-conceived Corrective Action Program may be instigated at the earliest possible time.

Comments on Subsection 2550.9(b):

Comment: Subsection (b) does not instruct the discharger in how to proceed with the investigation of the release other than to require that the nature and extent of the release be delineated. More detail should be provided. **[4H,13I,20G]**

Response: The regulations were not changed in response to this comment for the following reasons. The hydrogeologic conditions underlying each unit differ from those under any other unit and each release at a given unit will differ from all previous releases at that unit. Therefore, it is not possible to detail all the specific actions that would be necessary in each such permutation. Instead, the discharger is required to come up with a constituent-specific delineation of the nature and extent of the release using whatever means are necessary to accomplish this goal within 90 days of discovering the release. This approach places the burden upon the discharger to get the job done rather than upon the regional board to guide each little step of the process. If the discharger has completed this delineation on time and to the satisfaction of the regional board, then a major step has been taken toward the development and implementation of an appropriate corrective action program. If the discharger fails to provide a delineation report before the 90 day deadline or provides an inadequate report, then the discharger is subject to administrative financial penalties for failure to perform a required action. This provision therefore provides the regional board with the leverage necessary to obtain the needed information within a reasonable time framework, while at the same time providing the discharger with the latitude to accomplish the delineation using any viable means. This approach is much more efficient than an approach in which every little action on the part of the discharger must first be either approved by the regional board or laid out exhaustively in regulations.

Subsection 2550.9(c)

Releases are dynamic phenomena, therefore, it is necessary to ensure that the Corrective Action Program is designed based on the most current available site-specific data because the corrective action measures used will not be effective if they address historic conditions that are no longer valid. In most cases, the plume delineation effort under revised Subsection (b) of this section will not be completed prior to the original submittal of the feasibility study required under revised Subsection 2550.8(k)(5)(A) of this article. The feasibility

study is intended to be the basis around which the Corrective Action Program is built, therefore, it must be updated to reflect the information gained during the Evaluation Monitoring Program. This subsection represents a nonsubstantial change from Subsection 2557(g) of repealed Article 5 and is needed in order to assure the expeditious development of appropriate corrective action measures.

Subsection 2550.9(d)

This requirement is necessary in order to assure an effective Corrective Action Program is implemented. An amended Report of Waste Discharge [ROWD] is required to respond to the statutory requirement that a discharger report material changes in discharge. Leakage from containment is a material change [perhaps abrogating the conditions that justified authorization of discharge in the first place]. Therefore, a new ROWD is required, resulting in a revised and modified set of Waste Discharge Requirements to impose new discharge requirements reflective of the changes brought about by the release.

Subsection (d)(1) requires the ROWD to include a delineation of the release in order to assure that the corrective action measures and monitoring program proposed under Subsections (d)(3) and (d)(4), respectively, will be capable of addressing the entire release.

The ROWD must also include a proposed Water Quality Protection Standard. What makes this Standard potentially different from the ones used in other programs is that concentration limits used in corrective action may be different from background, in cases where it is not possible or not appropriate to clean up the background. The discharger wishing to obtain concentration limits greater that background is required under Subsection (d)(2) to propose to fully substantiate each such concentration limit because this is the point in time prior to corrective action when the discharger has the most knowledge concerning the nature and extent of the release and of the likely asymptotic endpoint concentration producible for each Constituent of Concern by the various corrective action remedies being considered.

The requirements under Subsection (d) represent a nonsubstantial change from Subsection 2557(g) of repealed Article 5 and are necessary because they provide the discharger with a clearly defined description of the ultimate goal of the Evaluation Monitoring Program and of the specific elements that the discharger must include in the ROWD.

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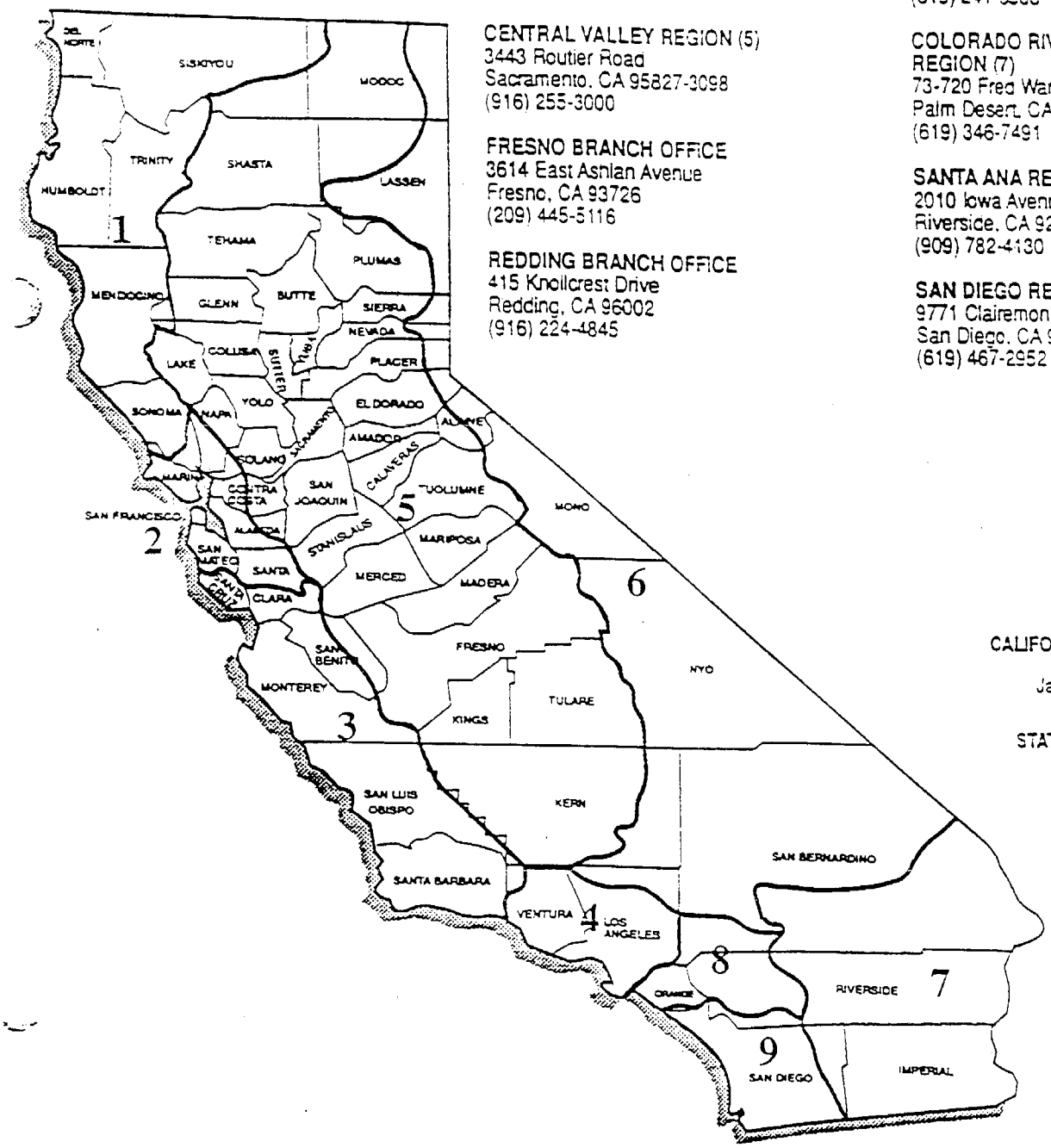

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