14. Statutory Determinations

The following statutory determinations apply to the remedial action selected by this ROD for the dual-site groundwater operable unit for the Joint Site. Previous sections provide much of the detail often expected in this section. For brevity, those sections are referenced as appropriate.

14.1 Protection of Human Health and the Environment

The remedial action selected by this ROD is protective of human health and the environment. The groundwater at the Joint Site, should it ever be used, would present an unacceptable risk. Because the groundwater continues to move, new portions of the resource can become impacted by contamination in the future. The NAPL itself serves as a principal threat which continues to contaminate groundwater. Regulations direct EPA to restore this groundwater to drinking water standards where it is practicable to do so (i.e. these standards are ARARs where not waived). The remedial action EPA is selecting to for the groundwater contamination at the Joint Site eliminates the health threats from contaminated groundwater, restores the maximum practical extent of the groundwater resource to usability, meets ARARs where technically practicable, contains the principal threat, and safely contains contamination with a significant degree of certainty where it is not practicable to meet ARARs.

The remedial action selected by this ROD hydraulically isolates the NAPL so that the largest reasonable portion of the contaminated groundwater can be restored to drinking water standards and to limit the potential for human exposure to contaminated groundwater. The remedial action arrests the further lateral and vertical movement of all dissolved phase plumes. NAPL recovery actions, as selected by subsequent amendment(s) to this ROD, may reduce and limit the potential for NAPL mobility, enhance the long-term effectiveness, and reduce uncertainties in the ability of the actions selected in this ROD to maintain protectiveness of human health and the environment over the long term.

This remedial action restores the groundwater outside the NAPL isolation zone to levels that would be safe to drink or use for any potable purpose. In doing so, it protects the human health of any persons who might come to use groundwater, either now or in the future, and eliminates the dissolved phase contamination in groundwater outside the containment zone. As discussed at length in Section 12 of this ROD, "Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative," the remedial action to restore groundwater (i.e. achieve plume reduction) outside the NAPL isolation zone will extend over a long time frame. Because of this, all alternatives considered in the remedy selection process provided a threshold level of protection of human health and the environment, but also provided a range of protectiveness in

terms of long-term certainty of attaining ISGS levels (drinking water standards) at all points in the groundwater that are subject to restoration. The remedial action selected by this ROD provides a highly significant certainty of ultimately attaining ISGS levels within groundwater outside the NAPL isolation zone. In addition, it provides significant early time performance, meaning to extent practicable, significant reductions in the size of the plume are achieved early in the remedial time frame. This both increases the certainty of long-term protectiveness, and provides the benefits of the remedial action to the greatest possible area, sooner. Because a significant portion of the groundwater resource is usable in a relatively short time frame, there is, over the course of the remedial action, a smaller area of groundwater that continues to pose unacceptable health risks. This means there is less opportunity for anyone over time to make use of water which poses an unacceptable health threat. This provides additional protectiveness to this remedial action. At the conclusion of the remedial action, groundwater at all points outside of the NAPL isolation zone will not pose a risk outside of EPA's 10^{-4} to 10^{-6} excess cancer risk range, nor a non-cancer risk which exceeds a hazard index of 1. Water inside the NAPL isolation zone will be contained, subject to contingent actions if transgressions of containment occur.

The remedial action was selected by considering the potential for interactions and adverse movements among the various distributions of contamination at the Joint Site. The various elements of the remedial action have been selected such that all objectives of the remedial action can be met. In addition to reducing and eliminating the contamination outside of the NAPL isolation zone, this includes safely and reliably containing the NAPL isolation zone and limiting the induction of movement of contaminants which may threaten the objectives of the remedial action. The size and configuration of the NAPL isolation zone, the aggressiveness of cleanup performance and approximate pump rates to be used, and the actions selected (e.g. reliance on intrinsic biodegradation for some areas, active hydraulic extraction for others) have all been selected to strike an appropriate balance among all of these remedial objectives.

As the remedial action progresses, but prior to its completion, there will remain an area of groundwater that would pose a health risk were it used. This remedial action requires periodic well surveys to identify any new groundwater use within the water contaminated by the Joint Site, requires sampling of such wells, and requires that alternative means of water be provided to persons using such water. This, in conjunction with the institutional controls EPA will seek to implement as part of this remedy, will ensure short-term protectiveness as the remedial action is being implemented.

This remedial action is not expected to present any other unacceptable short-term risks or cross-media impacts. All water will be treated to meet ARARs and/or independently applicable standards prior to discharge.

14.2 Compliance with ARARs

This remedial action will comply with all ARARs, except for those ARARs which are being waived as established by this ROD based on technical impracticability. The specific ARARs that shall apply to this remedial action, and the ARARs which are subject to TI waiver, are listed and discussed in Appendix A of this ROD. The TI waiver applies only to groundwater within the TI waiver zone as defined by this ROD.

As discussed at length in Section 12 of this ROD, "Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative," the remedial action to restore groundwater (i.e. achieve plume reduction) outside the NAPL isolation zone will extend over a long time frame. All alternatives considered in the remedy selection process met the threshold of compliance with ARARs, yet with long remedial time frames, ARAR compliance must be treated in terms of degrees of long-term certainty, rather than absolute certainty. Accordingly, alternative considered provided a range of long-term certainty of attaining in-situ ARARs (e.g. MCLs) at all points in the groundwater that is subject to restoration. The remedial action selected by this ROD provides a highly significant certainty of ultimately attaining in-situ ARARs within groundwater outside the NAPL isolation zone. The degree of aggressiveness, performance, pore volume flushing rate, and early time performance of this remedial action enhance the certainty of meeting ARARs in the long term.

As discussed in Sections 8 and 11 of this ROD, there are no ARARs, promulgated or provisional standards, or reliable toxicological surrogate compounds for pCBSA. However, this remedy adopts a ROD standard for injection of groundwater for the contaminant pCBSA, as discussed in Sections 11 and 12 of this ROD.

14.3 Cost Effectiveness

The remedy selected by this ROD is cost-effective. It uses sufficiently aggressive, but not overly aggressive actions given the conditions, acknowledges the impracticability of complete NAPL removal and contains cost-effective means for addressing it, utilizes intrinsic biodegradation to the extent it can be relied upon, and properly configures the TI waiver zone.

In general, in present worth terms, the alternatives which are more aggressive in terms of plume reduction for the chlorobenzene plume cost more. EPA noted that Alternative 3 presented would cost on the order of $26 million, but it provided unacceptable long-term performance, early time performance, insufficient and sporadic pore volume flushing rates, a low degree of certainty of ultimately attaining ARARs, and an extremely long cleanup time. For an additional $5 million (on the order of $31 million), Alternative 4 provides significant long-term and early time performance, significant and well-distributed pore volume flushing, a substantial degree of

certainty of ultimately attaining ARARs, and an much shorter cleanup time. Alternative 5 would cost an additional $10 million, as compared with Alternative 4. Alternative 5 would provide superior performance to Alternative 4 in all ways just discussed. However, the relative improvement in performance from Alternative 4 to Alternative 5 would not be as great as the improvement from Alternative 3 to Alternative 4; while the increase in cost from Alternative 4 to Alternative 5 would be twice as much as the increase in cost from Alternative 3 to Alternative 4. The JGWFS performed an analysis which showed that, solely on the basis of percent of plume removed per dollar spent, Alternative 4 was superior to the other alternatives. Of course, this simple calculation does not take into account all of the more intangible societal benefits of removing the contamination faster, which Alternative 5 would do. EPA believes, however, that Alternative 4 is an appropriate balance in terms of cost-effectiveness among the alternatives.

The remedial action selected by this ROD strikes a reasonable and appropriate balance between cost and meeting remedial objectives. It acknowledges the fact that, on the one hand, the groundwater within the Joint Site is not being presently withdrawn and used by people. At the same time, it recognizes that future groundwater use is possible, that further expansion of the contamination is possible, and that the groundwater is classified by the State of California as having potential beneficial potable use. The health risks posed by the Joint Site groundwater, should it be used in the future, are unacceptable and could be extreme. Action is warranted.

Accordingly, while not requiring that an exceedingly fast, highly aggressive, and costly remedy be implemented, this remedial action achieves a cleanup in a reasonable time frame, achieves substantial early time performance, and provides for substantial pore volume flushing with good coverage. The remedial action meets the ARAR of attaining the MCLs in all groundwater outside the TI waiver zone and does so with substantial certainty of ultimate success.

This remedial action does not unreasonably impose requirements that all groundwater, including that in the NAPL areas, be restored to drinking water standards. EPA has recognized up-front that doing so would not be practicable, and it would prove extremely costly to attempt to do it, only to empirically "prove" that a TI waiver is justified. Rather, EPA has issued the TI waiver in advance, and developed a prudent and cost-effective approach of isolating the NAPL hydraulically. This approach allows the greatest amount of groundwater to be restored to drinking water standards, while not requiring that the impracticable be achieved in the NAPL areas.

This remedial action properly relies upon the existence of natural intrinsic biodegradation in the benzene plume to achieve remedial goals. This greatly lowers the cost of the remedial action compared to an effort in which active remediation of the benzene plume in all units were required. To the extent that intrinsic biodegradation fulfills the purposes for which it is being relied upon, this greatly enhances the cost effectiveness of this remedy.

EPA also has not unreasonably limited the size and characteristics of the NAPL isolation zone. Had EPA not done so, complicated remedial efforts may have been required that would have greatly increased the costs of the remedial action. While costs were not the primary basis for making these adjustments and delineations to the TI waiver zone, the end result is a remedial action that is more cost-effective. EPA has allowed a reasonable NAPL isolation zone to ensure that pumping does not induce NAPL movement. Also, EPA has not imposed multiple tiny NAPL isolation zones separated by areas that theoretically must be "cleaned," when, in all likelihood, the potential for doing so would be minimal or nonexistent.

The costs of containing and reducing the size of the plume in the case of this remedial action are not inordinate compared to other sites where similar actions have been applied. The cost of this remedial action is reasonable in light of the very substantial protection of human health and long-term effectiveness that is afforded by the action.

14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The remedial action selected by this ROD meets the statutory preference to utilize permanent solutions, and apply treatment to the maximum extent practicable. It is not practicable at this time to remove all NAPL from the site; hence the highest degree of permanence, namely, removal of all contamination from the site cannot be attained. However, the NAPL isolation zone has been kept to the smallest reasonable size that is considered safe, and hence the maximum practicable portion of groundwater is subject to treatment. The alternative selected by this remedial action provides a substantial certainty of attaining ISGS standards outside the NAPL isolation zone in the long term. The remedial action would be permanent with respect to any groundwater areas which are restored to ISGS standards. Accordingly, the maximum practicable area of groundwater is subject to a significant degree of permanence.

While treatment is being employed to remove contaminants from the ground, it is true that groundwater hydraulic extraction and treatment is not, technically, an "alternative treatment technology." However, the size of the contaminant distribution at the Joint Site, and its significant depth across so many hydrostratigraphic units, precludes the use of the more highly innovative technologies now emerging for groundwater cleanup. Likewise, recovery of the contaminant for reuse is not practicable. The groundwater resource, as a whole, is being recovered for use to the greatest practicable extent by this remedial action, however.

It is noted that, in the second phase of remedy selection which will focus on NAPL recovery, both innovative or "alternative" technologies will not only be considered but will be essential;

likewise, recovery of NAPL from the ground, and potential reuse of the NAPL in some way, can be more practicably considered.

14.5 Preference for Treatment as a Principal Element

This remedial action satisfies the statutory preference for treatment as a principal element. Treatment of contamination, which physically removes the contaminant from the site both in terms of mass and volume of water affected, is employed by this remedial action. The principal NAPL threat is isolated and contained by means of hydraulic extraction, treatment, and injection (or discharge). The dissolved phase contamination outside the containment zone is likewise eliminated by means of hydraulic extraction, treatment, and injection (or discharge).

Natural intrinsic biodegradation is relied upon for meeting some of the remedial objectives of this remedial action. While intrinsic biodegradation is not a form of active treatment, it is, in a sense, a treatment in that bacteria are degrading and eliminating contaminant mass just as surely as if EPA had actively applied a man-made treatment. In *relying* on intrinsic biodegradation, EPA is using it as a monitored remedial mechanism. Should this mechanism fail to meet its objective, the ROD calls for active treatment to replace it. Hence, it can be said that the preference for treatment is met by reliance on intrinsic biodegradation, as well.