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Chemical Stockpile Disposal Program: Review and Comment on the Phase I Environmental Report for the Pine Bluff Arsenal, Pine Bluff, Arkansas

by J.R. Krummel, A.J. Policastro, S.J. Olshansky, and L.D. McGinnis*

Environmental Assessment and Information Sciences Division,
Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439

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*McGinnis is affiliated with Argonne's Energy Systems Division.

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ABSTRACT

As part of the Chemical Stockpile Disposal Program mandated by Public Law 99-145 (Department of Defense Authorization Act), an independent review is presented of the U.S. Army phase I environmental report for the disposal program at the Pine Bluff Arsenal (PBA) in Arkansas. The phase I report addressed new and additional concerns not incorporated in the final programmatic environmental impact statement (FPEIS). Those concerns were addressed by examining site-specific data for the PBA and by recommending the scope and content of a more detailed site-specific study. This independent review evaluates whether the new site-specific data presented in the phase I report would alter the decision in favor of on-site disposal that was reached in the FPEIS, and whether the recommendations for the scope and content of the site-specific study are adequate. Based on the methods and assumptions presented in the FPEIS, the inclusion of more detailed site-specific data in the phase I report does not change the decision reached in the FPEIS (which favored on-site disposal at PBA). It is recommended that alternative assumptions about meteorological conditions be considered and that site-specific data on water, ecological, socioeconomic, and cultural resources, and emergency planning and preparedness be considered explicitly in the site-specific EIS decision-making process.

1 INTRODUCTION

The U.S. Army is implementing a strategy for compliance with Title 14, Part B, Section 1412, of Public Law 99-145 (Department of Defense Authorization Act), which requires destruction of all lethal unitary chemical agents and munitions. As part of this strategy, the U.S. Army developed a two-tiered approach for compliance with the National Environmental Policy Act of 1969 (NEPA). The first part of this approach involved preparing a final programmatic environmental impact statement (FPEIS) (U.S. Army 1988a) to compare alternative strategies on a national scale. The analysis considered disposal technologies and locations. The second part of the two-tiered approach is now in progress and involves preparing site-specific environmental impact

statements (EISs) to assess the effects at each location from implementing the disposal technology selected in the FPEIS, that is, on-site incineration.

Because of comments received during the NEPA review of the FPEIS, the U.S. Army decided to conduct the site-specific NEPA impact analysis in two phases (U.S. Army 1988b). In phase I, site-specific data relevant to on-site disposal were to be further reviewed and analyzed for each installation. In phase II, the site-specific effects of constructing, operating, and decommissioning the incineration facility at each disposal location are to be considered.

The U.S. Army has prepared the phase I report for the Pine Bluff Arsenal (PBA), Pine Bluff, Arkansas (U.S. Army 1990). The report contains information on human health and safety, environmental resources, and emergency response that is specific to the area around PBA. The stated objectives of that report are to determine (1) whether new data presented in the phase I report would result in the rejection of on-site disposal at PBA as the environmentally preferred alternative (using the same methods and data-analysis tools as used for the FPEIS) and (2) whether the new data indicate the presence of significant environmental resources that could be affected by the implementation of on-site disposal at PBA.

The U.S. Army decided that the phase I report for PBA should be independently reviewed. This document presents the results of that review, which was conducted by research staff members at Argonne National Laboratory for the U.S. Army, Office of the Assistant Secretary, Installations, Logistics, and Environment. The Assistant Secretary requested that the reviewers determine the adequacy of the phase I report, whether new data should be evaluated, and whether evaluation of new data would change the environmentally preferred alternative selected in the FPEIS. Previous reviews, also conducted by Argonne National Laboratory staff, evaluated the phase I environmental reports for the Tooele Army Depot (Krummel et al. 1988) and the Anniston Army Depot (Krummel et al. 1989).

Figure 1 shows the approach used to compare the site-specific data and results presented in the FPEIS with the new information generated for the phase I report. If differences were found in comparing phase I data with the data presented in the FPEIS, the differences were to be examined for significance. If significant differences were found, the selection of this specific disposal site as an alternative was to be reassessed. If the differences were found to be insignificant, that conclusion was to be reported in the site-specific EIS.

The phase I environmental report contains detailed, site-specific data for a circular area within a 100-km radius of PBA. Two types of data are presented: (1) data to support the decision analysis presented in the FPEIS (Figure 1) and (2) environmental resource data required for preparation of the site-specific EIS in phase II. The phase I report does not incorporate any new modeling analyses or probabilistic accident scenarios; these analyses and scenarios are carried through unchanged from the FPEIS.

FIGURE 1 Phase I Concept and the Approach Used in this Review to Compare the FPEIS and Phase I Environmental Report (Boxes labeled *Review* are germane to this review report.) (Source: Adapted from U.S. Army 1988c)

2 APPROACH

This review compares the site-specific data used in the FPEIS with the data presented in the phase I report (Figure 1) and involves reviewing the data for completeness and adequacy to support modeling and computation of risk measures. This phase I review explicitly follows the decision methodology developed in the FPEIS. Krummel et al. (1988, 1989) provide information on application of the FPEIS methodology to decisions of adequacy and completeness and describe the types of data explicitly considered by the methodology. (Data adequacy applies to the phase I information in terms of choosing the most appropriate parameters and variables in the modeling analyses, as well as incorporating all potential receptors in analyzing potential effects of on-site incineration of chemical agents at PBA. In this case, the receptors are the people located around PBA. The modeling analyses depend on the phase I information to evaluate site-specific dose levels that could be experienced by the population located around PBA.) This review considers neither the U.S. Army Record of Decision (Federal Register 1988) nor the probabilistic accident analyses completed for the FPEIS to determine the chemical agent source terms.

This review also examines the information presented in the phase I report that will be used for the phase II site-specific EIS. Specifically, the review addresses the adequacy of the data to support a site-specific impact analysis. Although these data were not used in the FPEIS decision process, the information will be used both to define baseline environmental conditions at PBA and to conduct impact analyses for the site-specific EIS. In addition, recommendations are provided, where appropriate, on the types of information and analyses that should be included in the site-specific EIS.

Section 3 of this review examines the data explicitly used in the FPEIS methodology to make decisions related to disposal options. These data areas include meteorology, population, seismicity, and emergency planning. Section 4 of this review examines data that will be used in the site-specific EIS, but which was not explicitly included in the FPEIS decision methodology. These data areas include water, ecological, social, economic, and cultural resources. Section 4 also contains recommendations for site-specific data and analysis requirements for meteorology, population, and emergency planning.

3 DATA THAT APPLY TO THE FPEIS DECISION

3.1 METEOROLOGY AND ATMOSPHERIC DISPERSION

The PBA risk assessments require the use of dispersion modeling predictions. The D2PC model was used for the two sets of meteorological scenarios developed in the FPEIS -- *conservative-most-likely* and *worst-case* scenarios. Conservative-most-likely conditions were chosen as class D atmospheric stability and 3 m/s wind speed (denote by the designation D,3); worst-case conditions were selected to be class E stability and 1 m/s winds (E,1). The D,3 scenario assumes a frequently occurring meteorological condition that results in relatively large agent doses as compared with other frequently occurring conditions. The E,1 scenario is intended to represent a credible condition that results in near-maximum doses. Predictions based on these two meteorological scenarios were used to estimate how the population would be affected by the five measures of risk used in the FPEIS (U.S. Army 1989a).

Evaluation of other possible relevant data for use in the phase I report revealed that (1) all surface and tower meteorological parameters measured on a regular basis in the vicinity of the proposed Chemical Stockpile Disposal Program site at PBA were identified in the phase I report, and (2) no comprehensive dispersion studies have been carried out in the vicinity of the site that could be used to develop insight into flow patterns for potential accident releases. Seven meteorological towers are located on the installation. Two have wind instrumentation at 15 m, 30 m, and 60 m above ground. The phase I document used the data from the 15-m level of tower 6, while the FPEIS used the data from Pine Bluff Municipal Airport. At the time of preparation of the FPEIS, the seven-tower meteorological data system had not been in operation at PBA. Even though the area around the proposed incineration site is relatively flat, data from the other towers could, perhaps, have been analyzed to determine the representativeness of the tower 6 data and the kinds of flow patterns that pass through the site.

At Pine Bluff, the site is situated on flat ground about 20 m above the Arkansas River. Local relief is generally less than 10 m. The land is thickly wooded with pine and deciduous trees 20 m in height. No major terrain effects are expected, but forest canopy effects may be important (Yamada et al. 1989). Average summer mixing heights vary from 375 m in the morning to 1,900 m in the afternoon.

The meteorology of the area has two special characteristics of interest in this evaluation. First, during the summer, wind speeds are considerably reduced, especially at nighttime, with extended periods of calm. Winds are calm (winds less than 1 m/s) during 25-30% of the time in July and August. These calm conditions occur during both the daytime and nighttime, but primarily at night. The possibility of terrorism at any time (or perhaps expansion of incineration hours to the nighttime) precludes ruling out any time of day for accidental releases of chemical agents.

The second important fact is that these calm hours often occur during conditions of strong surface inversion. The temperature differences associated with this inversion can be from 5 to 10°C, as measured from the surface up to 60 m. The possibilities of very stable wind flows during a release, the concomitant long residence times of a

released plume, and the meandering motion of a slow-moving plume were not considered in the phase I report. The use of the straight-line Gaussian approach in the D2PC model therefore does not account for the likely change in direction of the flow due to low wind and very stable conditions that last for an extended period of time.

This change in direction of a very slow-moving plume can be important in evaluating impacts. For an elevated accidental release, the plume would stay elevated until morning fumigation conditions, and then the plume would come down to the ground. For an accidental surface release, the plume would spread along the ground from the source. For the phase I report, the estimated maximum number of fatalities associated with a particular downwind direction was computed by rotating the predicted D2PC plume in increments of one compass degree around the point of release. Fatalities were then computed for each of these increments. The absolute largest number of fatalities among all 360 computations was identified in the FPEIS as the *maximum number of fatalities* associated with the particular downwind no-deaths distance category. This methodology does not consider the likely possibility that the plume would change direction, e.g., follow a zigzag path, with long residence times.

Within the framework of the U.S. Army methodology presented in the FPEIS, however, *conservative-most-likely* and *worst-case* combinations of wind speed and stability class had to be selected on the basis of straight-line Gaussian theory and the meteorological data given in the phase I report. On the basis of the meteorological data presented in the phase I report, the stability/wind speed combinations chosen by the U.S. Army were D,3 for the conservative-most-likely scenario and E,1 for the worst-case scenario. These choices were identical to those in the FPEIS, and the measures of risk did not need to be recalculated on the basis of changes in meteorology. However, it is the reviewer's opinion that the choice of D,3 and E,1 conditions was subjective and that other meteorologists could reasonably choose and defend other stability class/wind speed combinations. Recommendations concerning this matter are made in the discussion of the site-specific EIS (Section 4.2).

3.2 POPULATION

In the FPEIS, the size of the residential (off-base) population near the PBA was based on 1980 U.S. census data. In the phase I report, 1986 population estimates from the Census Bureau were used. The methods used to distribute the population in the FPEIS and in the phase I report have been discussed and critiqued in previous reviews (Krummel et al. 1988, 1989). The data and methods used to identify the size and distribution of the off-base population in the affected area, and the new assumptions used in the phase I report for redistributing the population, were both valid and appropriate.

As a result of (1) updating the population counts provided by the Census Bureau, (2) excluding residents within the PBA boundary that were previously considered off-site, and (3) altering the coordinates of the proposed disposal site, it was estimated in the phase I report that 17,007 more people are located in the potentially impacted zone near the PBA than was estimated in the FPEIS. The revised population estimates resulted in an increase of 21,370 persons in the area from 50 to 100 km from the disposal facility.

Reductions in population occurred at distances of 0-2 km (-120), 2-5 km (-104), 5-10 km (-877), 10-20 km (-1,494), 20-35 km (-135), and 35-50 km (-1,633).

When these new population values were translated into revised fatality estimates, it was determined that 500 more deaths would occur under potential maximum worst-case meteorological conditions than was estimated in the FPEIS. Within specified distances from the site, fatalities would be greater at a distance of 50-100 km (+1,300), and less at distances of 20-50 km (-475), 10-20 km (-305), 5-10 km (-2), 2-5 km (-15), and 0-2 km (-3).

On the basis of the ranges of risk provided in Figure 10 of the phase I report (p. 3-25), the revised fatality estimates result in a one-shade increase in the probability of one or more fatalities with continued storage, and a one-shade decrease for on-site disposal. No change occurred in the shadings for maximum number of fatalities. In the phase I report it was stated that "as a result of fewer people living close to the proposed disposal site, small accidental releases of chemical agent, which in the FPEIS were predicted to cause fatalities within 2 km of the disposal facility, now would be predicted to produce no fatalities" (phase I report, p. 3-26). This difference is not based on an observed change in the actual distribution of people near the proposed disposal site. The difference is attributable to the use of the actual PBA installation boundaries in the phase I report in place of the generic boundaries of 500 m that were used in the FPEIS. That is, people that were distributed to areas between 500 m and 2 km from the proposed disposal area in the FPEIS were redistributed in the phase I report to areas beyond 1.2 km.

The method used to accept or reject the alternatives under consideration has been based on the subjectively determined, but operationally defined, term *significant differences*. The U.S. Army has accepted as its interpretation of a conservative gauge of *significant differences* between alternatives a measure of risk that allows for a ten-fold range of error in either direction and that requires a two-order of magnitude (e.g., 100-fold) difference in risk for four measures of risk. A fifth measure of risk requires a difference of 4,001 to an unknown number of maximum fatalities to result in a *significant* difference at the highest risk category (U.S. Army 1990, p. A-7).

It should be noted that to achieve a *significant difference* in risk (using the U.S. Army's definition of *significant*) in terms of maximum number of fatalities under worst-case conditions, the number of deaths would have to increase from 15,500 as estimated in the FPEIS to some larger number. This number cannot be determined from the pictogram provided in Figure 10 of the phase I report. Nevertheless, the probability that the estimated number of fatalities could increase to levels that would be *significant* using the U.S. Army's definition are extremely small, as noted by Krummel et al. (1989, p. 10). The only demographic conditions under which differences of this magnitude could occur are (1) with the recalculation of risk using on-site and special populations in the fatality estimates, and (2) under conditions where residential development occurs rapidly within very narrow and short distances from the site.

3.3 SEISMICITY

Conclusions drawn regarding consequences of earthquake activity and peak ground accelerations in the phase I report agree with current thinking of earthquake researchers in the eastern United States. Mention should be made, however, of reports by Talwani and Collinsworth (1988) and by Russ (1978) regarding evidence for paleoseismicity in the New Madrid region gathered from trenching in recent fluvial deposits. A statement is made in the Final Phase I Environmental Report (see p. 3-6, paragraph 6) from a reference to a paper by Thenhaus (1983) that "no confirmed surface ruptures have been discovered in strata of the Mississippi embayment region." Talwani and Collinsworth state that 13 sand blows and numerous small-scale normal faults crosscutting recent fluvial deposits were discovered in the trenching study of Russ et al. This statement directly contradicts that in the Final Phase I Environmental Report.

The review draft and the phase I report refer to work of two contractors who state that proposed disposal facilities would not be damaged by earthquake-generated soil liquefaction, assuming they are constructed on terrace deposits similar to those on which the disposal site for the BZ chemical agent is located. The phase I report should include reference to a report by Hopper (1985) that shows a map of areas of moderate to high liquefaction potential in Arkansas. Hopper's map supports the phase I statement and places the PBA between 50 and 60 km beyond the area of high potential for soil liquefaction surrounding the Reelfoot Rift.

A deterministic seismic risk summary in a contractors' report (Jacobs Engineering Group and URS/John A. Blume and Assoc. 1987) indicates that a maximum case earthquake at the site would be a repetition of the December 16, 1811, event of magnitude 7.5 near New Madrid, Missouri, and would be equivalent to peak ground acceleration produced by the maximum earthquake estimated for the Wichita-Ouachita province. This observation is conservative and also conforms with current thinking.

3.4 EMERGENCY PLANNING AND PREPAREDNESS

In the FPEIS and the phase I report, the risk reductions associated with emergency planning and preparedness used to support the decision for on-site disposal were not measured and compared with off-site transportation risks (U.S. Army 1990). No empirical evidence was presented to support the conclusion that emergency planning and preparedness would reduce the risk of an accident. It was noted in the phase I report that the risk measures for emergency response planning and preparedness were not necessary in this analysis. The phase I report also stated that no proven or acceptable method exists to quantify a potential reduction in impacts associated with emergency response planning and preparedness (U.S. Army 1990). These two statements are incompatible -- risk measures do not exist for emergency planning; therefore, these measures cannot be used in the FPEIS methodology.

The phase I report also stated (pp. 2-1, 2-5, A-7) that regional disposal of chemical agent stockpiles was considered and rejected, at the third tier of analysis (e.g., emergency planning and preparedness), because of the greater difficulty in providing

adequate emergency response along transportation corridors vs. on the site. This conclusion was not based on a quantitative analysis of alternatives.

There is no quantifiable basis for determining whether phase I report site-specific information on emergency planning and preparedness is sufficiently different from that considered in the FPEIS to alter the decision in favor of on-site disposal. A list of emergency response issues that have been addressed in documents supporting all of the phase I reports has been discussed by Krummel et al. (1989, pp. 11-13).

4 SITE-SPECIFIC EIS

4.1 METEOROLOGY

4.1.1 General

The meteorology and air quality section of the site-specific EIS should evaluate impacts of routine operation of the Chemical Stockpile Disposal Program (along with construction impacts), as well as impacts to human populations from the accident scenarios.

Relative to routine operation, on-site meteorological data should be used to evaluate compliance with air quality standards at the site boundary (see p. 3-4 of the phase I report). Finally, off-site air quality impacts and noise impacts from construction of the disposal facility should be evaluated. In addition, impacts at the nearest Class I area (Caney Creek Wilderness Area), located 184 km from the site, should be studied.

4.1.2 D2PC Model and the Choice of Meteorological Conditions

The D2PC model was used in the FPEIS for dispersion analyses to evaluate the consequences of the various off-site transportation and on-site accident scenarios at all eight stockpile sites. The D2PC model actually is applicable only to dispersion in reasonably flat terrain under simple meteorological conditions. The errors that arise in application of the D2PC model to a specific site depend strongly on how the assumptions in that model match the actual conditions at the site being studied. The EIS document for each depot is supposed to assess site-specific impacts of implementing the Chemical Stockpile Disposal Program and to evaluate possible alternative locations for the incineration facility within the depot. The D2PC model probably can be applied to PBA because the terrain in the area around the site is relatively flat.

Another important issue for the site-specific EIS relates to the meteorological conditions selected for the dispersion analysis (Section 3.1). The D,3 and E,1 conditions selected for the FPEIS analysis were subjective choices, and it is not certain that they represent conservative conditions. Table 1 of the phase I report presents the joint frequency of stability and wind rose for tower 6. These data indicate frequencies of 6.7% for A stability, 12.1% for B stability, 23.6% for C stability, 35.1% for D stability, 15.9% for E stability, and 6.6% for F stability. An analysis of tower 1 data (Yamada et al. 1989) at the 15-m level indicated that frequencies of E, F, and G stabilities were 12.6%, 15.2%, and 12.0%. No data in Table 1 in the phase I report or its accompanying text (U.S. Army 1990) and no data from tower 1 analyzed by Yamada et al. (1989) provide any substantive reason for selecting the D,3 and E,1 meteorological conditions for study. Other meteorologists could reasonably make other choices.

It is recommended that the Army consider remodeling dispersion characteristics with other reasonable stability and wind speed combinations (such as D,5, D,1, and E,3 for conservative-most-likely; and F,1 and F,3 for worst-case scenarios) and then compare

projected doses to the population for these other combinations. Special attention should be paid to the near-stagnation conditions that occur frequently and for long periods under strong inversion conditions during July and August.

It is important to recognize that the meteorological scenarios selected are important only because they are needed to compute potential dosage values for the population near PBA. Depending upon the relative location of the population with respect to PBA, the largest dose to the public may or may not result from the D,3 and E,1 conditions. Only through a sensitivity analysis with respect to wind speed and stability class can the effect of the subjective choice of meteorological conditions be evaluated.

In the phase I report, the D stability, 1 m/s alternative was also analyzed (in addition to the subjective choices of D,3 and E,1 as described above). It was postulated that the D,1 alternative might lead to greater impacts for the conservative-most-likely condition since D stability plumes ought to spread over a larger area than E stability plumes. As it turned out, only the shading pattern for "expected plume area" for the on-site disposal alternative changed. It increased by one shading pattern in both of the two new sets of pictograms (U.S. Army 1990, p. 3-29). That was not found to be a significant difference from the FPEIS estimated risks. However, the other combinations of stability class and wind speed were not evaluated. The other combinations should be examined for the site-specific EIS. In addition, the effects of the presence of the Arkansas River and forest canopy on the transport and diffusion of an accident plume should be discussed and evaluated quantitatively. These evaluations should be made in conjunction with the more important study of the effects of the extended near-stagnation conditions. The impacts to on-site personnel should also be included in the dosage comparisons with the different stability class/wind speed combinations.

4.2 POPULATION

It is noted in the phase I report that on-post and special populations near PBA will be considered when estimating potential fatalities for the site-specific EIS. The use of these more detailed data is both valid and appropriate. It should also be acknowledged that the authors of the phase I report did a thorough job of identifying the off-post resident and worker populations, transient populations, and special populations within a 100-km radius of the site. Given that the risk calculations were based on exposures only to healthy adult males, and the fact that some subgroups of the population (e.g., children up to 14 years old and adults 65 and older) are much more sensitive to chemical agents than healthy adult males (U.S. Army 1990, p. B-1), the new age-specific data for off-post populations should be used in the site-specific EIS to generate more accurate risk calculations. Finally, the phase I report presented fatality estimates in each table in a cumulative format by distance from the proposed facility (although the tables were not labeled accordingly), while the population distributions were presented in an incremental format with totals at the bottom of the table. To reduce the likelihood of confusion, it is suggested that tables showing the estimated number of fatalities should be comparable in style and format to those showing the population distributions.

4.3 SOCIAL, ECONOMIC, AND CULTURAL RESOURCES

Unlike the method used to conduct the population analysis, systematic methods or models were not used in the FPEIS and phase I report to analyze data associated with social, economic, and cultural resources. For both the FPEIS and phase I report, data were collected on public services/infrastructure and economic resources for the counties within a selected radius of PBA, but even if the data collected for the phase I report indicated that *significant differences* in impacts were expected as compared with those projected in the FPEIS, this would not alter the decision in favor of on-site disposal. This is because social, economic, and cultural resources were not explicitly used in the decision-making process. It is suggested that social, economic, and cultural issues should be included explicitly in the decision-making process for the site-specific EIS.

4.4 WATER RESOURCES

As the phase I report indicates, risks or impacts to surface water and groundwater resources were not considered in the FPEIS decision methodology. Therefore, it is not necessary to compare the data presented in the FPEIS and the phase I report. Rather, the phase I report presents site-specific information on surface water and groundwater that will be used in the EIS impact analysis for PBA. The site-specific data will be used to quantify the baseline environment, to map water resources that occur within the region of influence described in the FPEIS (100 km), and to provide information on initial conditions for analysis of surface and groundwater flow dynamics. These studies will provide the information needed to judge the site-specific human health and aquatic ecosystem risks associated with on-site disposal at PBA.

The surface water information presented in the phase I report provides sufficient site-specific data on the location of rivers, streams, and reservoirs within the region of influence. In addition, information presented on flow rates for the primary streams and rivers quantifies mean flow and average withdrawal rates. No new information exists or was developed for the phase I report relative to the presence of surface water that would affect the FPEIS decision for on-site disposal. Surface water information contained in Appendix C of the phase I report provides sufficient detail for the affected environment section of the site-specific EIS. Appendix C provides the level of detail needed to inform the public and decision makers of the drainage patterns at PBA. This information can be used to explicitly examine accident impacts on surface waters in the vicinity of Pine Bluff.

Because the FPEIS decision methodology did not consider water resources, the impact analysis for the site-specific EIS will contribute important new information to the implementation of on-site disposal at PBA. Since the Arkansas River is less than 1 km from the proposed disposal location, the EIS should explicitly quantify potential deposition of chemical agent in the river. Deposition values should be derived from the accident data base developed for the FPEIS.

Groundwater information contained in Appendix C of the phase I report provides sufficient detail for the affected environment section of the site-specific EIS. The new information presented in the phase I report related to the Lockfield-Jackson Aquifer and

the potential connection between Sparta Sand Aquifer and the overlaying water-bearing formations because of water withdrawals at PBA would not alter the decision for on-site disposal. The phase I report is correct in stating that groundwater can be directly impacted by spills. However, because of the presence of an aquitard, accidental releases of agent that could affect groundwater resources would not affect human health or the biota. This conclusion is based on the assumption that the groundwater would be adequately monitored during disposal and decommissioning.

4.5 ECOLOGICAL RESOURCES

In the FPEIS, explicitly protected ecological resources were listed as being at risk from accidental releases of agent. However, these resources were not used to quantify ecosystem risk; the atmospheric dispersion model was used to measure ecosystem risk by defining the expected plume area around the PBA disposal location. Implicit in this calculation is the assumption that the greater the plume area, the larger the impact to the surrounding biota. The calculation and thus the subsequent index of risk did not change during the phase I analysis. Therefore, inclusion of all protected ecological resources in the phase I report is only necessary to support impact analyses in the site-specific EIS.

The phase I report identifies and maps the locations of all publicly owned land areas within 100 km of PBA that contain natural ecological systems. In addition, all threatened and endangered species are identified for inclusion in the EIS. For major natural areas and important habitat for threatened and endangered species, that information adequately defines the baseline environment in the PBA region. Impact analyses of these ecological resources conducted for the site-specific EIS would serve as an acceptable index of potential impacts to biological and ecological resources within the entire 100-km area surrounding PBA.

The phase I report does not provide any data on terrestrial or aquatic biota at the PBA installation properties. These data are essential for completion of the site-specific EIS. For example, information on the locations of plant communities and animal habitats is needed to judge the impacts of road construction. It is recommended that ecological data from the installation be presented in the site-specific EIS and that this information be used in the impact analysis of disposal facility construction and operation.

4.6 EMERGENCY PLANNING AND PREPAREDNESS

For emergency planning, the U.S. Army is currently considering the use of D2PC and other computer codes (including HOTMAC/RAPTAD of Los Alamos National Laboratory and the MACH codes of the Atmospheric Sciences Laboratory, White Sands Missile Range) in an emergency preparedness model for PBA. This type of modeling plan is a good one, and it should be recognized that the individuals responsible for executing the codes in an emergency (daytime or nighttime) should have sufficient training and experience in meteorology to be able to properly use the models under a variety of conditions.

5 CONCLUSIONS

Applying only the decision methodology used by the U.S. Army in the FPEIS and phase I report, there are no *significant* differences between the information presented in the FPEIS and that presented in the phase I report for PBA. The projected number of people exposed to accidental releases of chemical agent was found in the phase I report to be larger (by 17,007 people) than the estimates contained in the FPEIS. As a result, the number of expected fatalities under worst-case conditions increased from 15,500 in the FPEIS to 16,000 in the phase I report. The FPEIS methodology required an increase that exceeded some number larger than 16,000 (or a 100-fold increase in the other measures of risk) to be considered *significant* enough to reject on-site disposal. Other than changes in estimates of the size and distribution of the human population and the use of data from a different meteorological tower, no other data were altered in the phase I report.

The phase I report adequately describes the current environmental conditions at the PBA and the surrounding region. The information contained in the phase I report adequately address surface or groundwater attributes needed to analyze impacts to water users or aquatic biota. Additional seismic data supports the phase I conclusions on seismic risk. It is recommended that other likely meteorological conditions be evaluated with the D2PC dispersion model in the site-specific EIS to determine if these different conditions alter dispersion patterns.

Under the FPEIS and phase I process, only one proposed disposal location has been considered for the PBA. Although this site location has been subjected to preliminary engineering analyses, the U.S. Army, in the site-specific EIS process, is committed to evaluating other on-site locations if environmental impacts at the initially proposed site are of a magnitude to warrant facility relocation. If other locations are considered in the EIS, the FPEIS risk measures will have to be recomputed to determine the magnitude of any change in the risk measures. The determination of whether changes in the risk measures that result from these recomputations are significant will also be based on subjective criteria for significance that are formulated by the U.S. Army.

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