UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ARIZONA PUBLIC SERVICE COMPANY, ET AL	)	Docket Nos. STN 50-528 STN 50-529 STN 50-530
	)	
(Palo Verde Nuclear Generating Station, Units 1, 2 and 3)	)	

NRC STAFF'S PROPOSED OPINION, FINDINGS OF FACT, CONCLUSIONS OF LAW, AND ORDER IN THE FORM OF AN INITIAL DECISION

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August 23, 1982

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OPINION

I. BACKGROUND

This Initial Decision concerns the application filed with the Nuclear Regulatory Commission by the Arizona Public Service Company, Salt River Project Agricultural Improvement and Power District, Southern California Edison Company, El Paso Electric Company, and the Public Service Company of New Mexico (hereinaftear collectively "Applicants") for a facility operating license which would authorize the operation of the Palo Verde Nuclear Generating Station, Units 1, 2 and 3 (hereinafter "Palo Verde facility" or "facility"). The Arizona Public Service Commission is responsible for operation of these three pressurized water reactors. Each reactor is designed to operate at a rated output of 1,270 megawatts of electric power. The Palo Verde facility is located on

Applicants' site in Maricopa County, Arizona, approximately 36 miles from the City of Phoenix.

In May 1976, following technical review by its Staff and its Advisory Committee on Reactor Safeguards, and a favorable Initial Decision on May 24, 1976 (LBP-76-21, 3 NRC 662 (1976), by an Atomic Safety and Licensing Board, the Nuclear Regulatory Commission issued a construction permit for the Palo Verde facility. Following docketing of the application for an operating license, on July 25, 1980, the Nuclear Regulatory Commission published in the Federal Register notice of an opportunity for a hearing on the issuance of the facility's operating license. (45 Fed. Reg. 49732). In response to that notice, Ms. Patricia Lee Hourihan submitted a Petition for Leave to Intervene and Request for a Hearing. Her petition was granted by this Licensing Board on April 16, 1981. On September 17, 1981, the Attorney General of the State of New Mexico filed a Motion to participate as an interested state agency pursuant to the provisions of 10 C.F.R. § 2.715(c). At a November 18, 1981 Prehearing Conference, the Board granted this motion.

By memorandum and Order on April 16, 1981, the Board approved the admission of five contentions for litigation and allowed the Intervenor the opportunity to file additional contentions with respect to emergency planning. The Intervenor later withdrew two of these contentions. The Applicants and Staff filed motions for summary disposition of the remaining three contentions. In its Order of March 29, 1982, this Board granted summary disposition on two of these contentions.

The only remaining contention for litigation was Intervenor's Contention 5 which contended that:

> Applicants will not have an assured supply of useable treated municipal effluent for cooling purposes for Unit 3 of PVNGS during months of peak reactor need for the first five years of operation.

At the first day of the hearing, on April 27, 1982, Contention 5 was expanded to include the question of: (i) whether there is an assured source of effluent for all three units rather than just Unit 3; (ii) whether a greater amount of effluent will be necessary for the Palo Verde units if there is a poorer quality of effluent than that which is presently expected; and (iii) whether there is any safety concern with respect to the effluent issue. (Findings 1-2).

Evidentiary hearings were held in Phoenix, Arizona on April 27-30, May 25-28, and June 22-25, 1982. An opportunity to present limited appearance statements was given during portions of the day on April 27 and 28, 1982. At the conclusion of the presentation of the case in chief and rebuttal, the record in this proceeding was closed on June 25, 1982. (Tr. 2710).

The decisional record in this proceeding consists of the following:

a. The Commission's Notice of Hearing;

b. The material pleadings filed herein, including the petitions and other pleadings filed by the parties, and the orders issued by the Board during the course of this proceeding;

c. All of the exhibits received into evidence.

In making its findings in this proceeding, the Board considered the entire record and all of the proposed findings submitted by the parties. Each of the proposed findings of the parties which is not incorporated directly or inferentially in this Initial Decision is rejected as being

unsupported in fact or in law or as being unnecessary to the rendering of this Decision.

II. SOURCES OF EFFLUENT FOR THE PALO VERDE UNITS

The Palo Verde Units 1, 2 and 3 will obtain municipal waste water effluent for cooling purposes under an April 23, 1973 contract, entitled "Agreement 13904", between Joint Applicants and the Cities of Phoenix, Glendale, Mesa, Scottsdale, and Tempe, Arizona (hereinaftear collectively referred to as "Cities") and the town of Youngstown, Arizona. The primary source of effluent under Agreement 13904 will be from the City of Phoenix's 91st Avenue Sewage Treatment Plant ("91st Avenue Plant"). There is also a secondary source from the City of Phoenix's 23rd Avenue Sewage Treatment Plant ("23rd Avenue Plant"). In addition, a relatively small amount of effluent for the Palo Verde Units will be supplied by the City of Tolleson, Arizona. Under the terms of Agreement 13904, Applicants may take up to 140,000 acre feet per year (afy) of effluent from the 91st and 23rd Avenue Plants subject to the availability of such amounts after satisfaction of prior commitments by these treatment plants. (Findings 3-9).

III. THE ADEQUACY OF EFFLUENT SUPPLY AS DETERMINED BY APPLICANT AND STAFF WITNESSES

During the past decade two different sets of studies have been prepared which project future amounts of effluent which will be produced at the 91st Avenue and 23rd Avenue Plants. One set was funded and prepared by the Environmental Protection Agency and the U.S. Corps of

Engineers on behalf of the Maricopa Association of Governments (the MAG 208 Studies) and the other set was prepared by the City of Phoenix (the "Phoenix Studies"). The MAG estimates are more conservative than the City of Phoenix's in projecting the amount of uncommitted effluent which will be available from the 91st and 23rd Avenue Plants. (Finding 10).

During the hearing, witnesses for the Applicants and Staff testified that the scheduled effluent supply from the 91st and 23rd Avenue Plants and the City of Tolleson was more than adequate to meet the cooling needs for Palo Verde Units 1, 2 and 3. Both witnesses utilized the MAG 208 and Phoenix effluent supply studies as part of their analyses and both determined that, even based upon the more conservative MAG projections, there will be an ample amount of effluent available to cool Palo Verde Units 1, 2 and 3 during the first five years of operation. (Findings 12-15).

Staff witness Raymond Gonzales calculated effluent supply by utilizing the most up-to-date MAG 208 and Phoenix projections that were available at the time he made his analysis. Using the MAG 208 projections, he calculated that in June 1986, the most critical time frame to examine insofar as effluent requirements are concerned, the 91st Avenue Plant would produce about 71.3 million gallons per day (mgd) of effluent after other commitments besides Palo Verde's were subtracted. Using the projections of the City of Phoenix, he calculated that there will be 86.7 mgd of uncommitted effluent in June 1986. Because the projected cooling water requirements for three Palo Verde units will only be 70.2 mgd at this time, Mr. Gonzales concluded that both of these studies established that the effluent supply from the 91st Avenue Plant

alone, without receiving any contributions from the 23rd Avenue Plant or from Tolleson, would be sufficient to meet Palo Verde's cooling requirements during the first five years of operation. (Findings 12-13).

Applicants' witness Richard Hulse also concluded that effluent from the 91st Avenue Plant alone was sufficient to satisfy Palo Verde cooling requirements for Units 1, 2 and 3. The time frame encompassed in Mr. Hulse's calculations was for each month during the years 1985 through 1987. His calculations were conservative because he utilized 1979 MAG 208 projections which had the lowest effluent projections for the 91st Avenue Plant of any MAG 208 or City of Phoenix study since 1977.

Reinforcing the testimony of Messrs. Gonzales and Hulse that there is sufficient effluent for Palo Verde, were a number of reports including an official City of Phoenix report on effluent usage showing that in June 1981, a total of 2154 afy (per unit) of effluent was obtained from the 91st Avenue and Tolleson plants which is approximately the same amount of effluent as the 2177 acre feet per unit that will be required during June 1986 when all three Palo Verde units will be operating. (Findings 14-15).

IV. ALLEGED UNCERTAINTIES REGARDING THE PALO VERDE EFFLUENT SUPPLY

Although not conceding the accuracy of Messrs. Gonzales' and Hulse's calculations, the Intervenor has not substantially attacked the analysis of these witnesses. Instead, one of the Intervenor's main arguments is the speculative and conjectural assertion that the effluent contracted for under Agreement 13904 may not be available. The Intervenor's argument goes on to assert that there are a number of water supply

uncertainties in the Phoenix area which potentially may cause water shortages. If water shortages occur in the Phoenix area, according to the Intervenor, Cities (as owners of the effluent at the 91st and 23rd Avenue Plants) can invoke Section 21 of Agreement 13904 and keep the effluent themselves. Section 21 provides, inter alia, that the Cities shall have the right to refuse delivery of effluent if there exists a critical need for water to be used for domestic purposes. (Findings 36-38)

To better understand the context of these arguments, it is necessary to outline the water supply situation in the Phoenix area. One of the main suppliers of water is the Salt River Project (SRP), a municipal corporation, which among other things, acts as an agent in delivering surface and groundwater to member lands within its boundaries. There is a prohibition against taking water outside SRP boundaries without replacing it. The SRP has surface water resources from the Salt and Verde Rivers and receives groundwater from 249 deep well pumps. With the exception of Scottsdale, at least a portion of the Cities which are signatories to Agreement 13904 are located within SRP boundaries and receive SRP water. Portions of the Cities of Phoenix, Tempe, and Mesa are located outside SRP boundaries. Their off-project areas are served by groundwater from wells owned by these cities. In addition to groundwater, the City of Phoenix serves its off-project areas from additional water that is obtained from what is referred to as "gate water credits." This is water Phoenix earned by having paid for the construction of gates at the Horse-Shoe Dam to trap excess Verde River surface water. (Findings 20-23).

Another source of supply for off-project SRP lands in the future will be obtained from the Central Arizona Project (CAP). It is projected that 1.6 million acre feet per year (afy) of Colorado River water will be brought into Central Arizona by CAP and, of this amount, 638,000 afy will be dedicated to municipal and industrial users. CAP construction will be completed in the Phoenix area in 1985. The only lands in the Phoenix area where CAP water is scheduled to be delivered are those outside of SRP boundaries. SRP lands will not receive this source of water supply since they will have sufficient water due to their continued urbanization and the abundance of SRP surface water (the agricultural use of land has a lighter water usage per acre than newly urbanized land.) (Findings 25-28).

A. THE ALLEGED WATER SHORTAGES IN THE PHOENIX AREA

In an attempt to establish a "critical need" under Section 21 of Agreement 13904 warranting the Cities to exercise their contract right to interrupt the Palo Verde effluent supply, the Intervenor has sought to demonstrate that there are a number of future water supply uncertainties which could cause water shortages in the Phoenix area. One area where such uncertainties exist, according to the Intervenor, is the potential for water shortages that could be caused by well contamination, restrictions on the amount of wells that can be drilled extended draught, and a number of potential uncertainties regarding the supply of water from the Central Arizona Project (Finding 37).

The Intervenor's allegation with respect to future water supply shortages in the Phoenix area is refuted by the testimony of Mr. Richard Juetten and Mr. Wesley Steiner. Mr. Jeutten, the Manager of Water

Resources and Services for the Salt River Project, has worked with the SRP in water supply related matters for the past twenty-seven years. As part of his testimony in this proceeding, Mr. Juetten prepared an analysis of future water supply adequacy in the Phoenix area which was separated into two parts, one dealing with the adequacy in areas within SRP boundaries and the other in areas outside the SRP. Information for this analysis was obtained from City of Phoenix officials and from official records of SRP. For those portions of Cities that are within SRP boundaries, Mr. Juetten calculated that such SRP lands are presently entitled to more water than they are using. He also predicted an ample water supply for SRP project lands in the future as a result of the continuing urbanization of agriculture land. For those portions of Cities with service areas partially outside the boundaries of the SRP, Mr. Juetten testified that their groundwater supplies will be sufficient to meet their off-project needs until the advent of Central Arizona Project water in 1985. (Findings 29-33). Mr. Wesley Steiner, Director of the State of Arizona's Department of Water Resources, also believed that the Phoenix area's future water supply is adequate. Mr. Steiner testified that water from the Salt River Project, the Central Arizona Project and groundwater will be sufficient to meet the Phoenix area's municipal and industrial water needs for the next fifty years.[1/] (Finding 34)

1/ We give much weight to Mr. Steiner's testimony because of his position as head of the State of Arizona's water resource programs and his twenty-six years of experience with the CAP and other Arizona water related matters. Most of this experience was in high management positions, including having the lead role in State of Arizona water resource matters since February 1969. (Finding 34).

In addition to the positive testimony of Messrs. Steiner and Juetten that there will be an adequate future water supply in the Phoenix area, this Board also concludes, for the reasons discussed below, that the uncertainties raised by the Intervenor concerning this subject are remote and speculative and fail to establish that there is not a reasonable assurance that the Palo Verde units will have an adequate supply during the first five years of operation, or for that matter, at any time in the forseeable future.

1. Central Arizona Project concerns

The alleged uncertainties raised by the Intervenor regarding the CAP water supply to the Phoenix area were largely refuted by Mr. Steiner. Mr. Steiner's opinions were based on comprehensive studies made by the State of Arizona which took into account such matters as the Colorado River flow from 1906 to date and the amount of development that he expected to occur in the upper and lower basin states. Also involved were manual and computer studies of water supply and storage systems along the Colorado River. Regarding the adequacy of the CAP water supply, Mr. Steiner testified that the State of Arizona will receive at least 1.6 million acre feet of CAP water beginning in 1985 and declining gradually to 1.3 million in 2034. Because of reservoir storage, it was his belief that there would be 1.6 million acre feet of water available for CAP in 1985 through 1988. He further noted that the State of Arizona would not even be able to fully utilize this amount of water during those years (Findings 62-64).

Specific points raised by the Intervenor regarding CAP were at best conjectural. The Intervenor suggested that shortages of CAP water could arise due to the low priority the State of Arizona has for Colorado River water, possible delay in building CAP, draught along the Colorado River, and various legal and political matters that could potentially adversely affect CAP. None of these potential occurrences raised by the Intervenor were supported by studies or calculations to establish whether the alleged occurrences would have a significant impact upon the Phoenix area water supply. In most instances, the Intervenor's witnesses did not even attempt to establish when any of these potentialities might take place and the amount of water that could potentially be lost by the occurrences of any or all of them. (Findings 65-73).

2. Groundwater concerns

The Intervenor also raised uncertainties concerning the groundwater supply. One of these concerns was the fact that there is a new Groundwater Management Act in the Phoenix area that can potentially limit the number of new wells that may be drilled. However, the evidence of record does not establish a likelihood that the Cities will be unable to drill sufficient wells to meet their water supply needs. Under the new Act, the State of Arizona has no authority to deny a permit to a City to drill a new well as long as the drilling takes place in its service area. Furthermore, Cities are not prohibited fron expanding their service areas. Cities are also allowed to withdraw from any particular service area well that amount of groundwater necessary to supply its customers. (Findings 74-77).

Another alleged groundwater uncertainty raised by the Intervenor concerned possible groundwater contamination in the Phoenix area. However, the evidence fails to establish that there will be a substantial number of contaminated wells or loss of groundwater in the future. (Findings 87-88). In addition, most contamination problems can be solved by such remedial action as: (a) contamination prevention programs (e.g. meeting EPA standards for waste disposal), (b) the treatment of contaminated water to make it suitable for human consumption, and (c) the cleanup of landfill areas. Furthermore, if a well becomes contaminated, a City also can take corrective measures by drilling another nearby well into the aquifier to replace the lost well. (Finding 90).

B. OTHER ALLEGED UNCERTAINTIES REGARDING THE SUPPLY OF EFFLUENT FOR THE PALO VERDE UNITS

1. Subregional and satellite treatment plants

In addition to these aforementioned arguments regarding possible future water supply shortages, the Intervenor also set forth various other potential problems with respect to the Palo Verde effluent supply. The Board concludes these too are extremely speculative and conjectural and fail to establish that the Palo Verde Units do not have a reasonably assured source of effluent.

One of these other alleged problems is that additional waste water treatment plants may be built in the future in the Phoenix area that could divert some of the effluent going to the 91st and 23rd Avenue Plants. This concern is directly refuted by the May 1982 MAG 208 Update which projected that there will be an increased amount of effluent

available in the future and that any new plants should not substantially divert effluent from the 91st and 23rd Avenue Plants. A further assurance that there will be sufficient effluent for Palo Verde is a contractual provision in Agreement 13904 specifically providing that Cities are not allowed to install new waste water treatment plants that will impair their ability to deliver effluent. (Findings 40-46).

2. Trades of effluent for CAP water

The Intervenor also contended that the Palo Verde effluent supply may be jeopardized by a proposed exchange of 100,000 afy of municipal effluent to certain Indian tribes as part of the CAP program. The Board does not believe this potential exchange threatens the Palo Verde effluent. The record establishes that this exchange is not intended to take place unless prior effluent commitments are satisfied. (Finding 50). Even if this were not the case, such exchanges would not affect the Palo Verde units during the first five years of operation since the proposed Indian exchanges will not take place until after the year 2,000. (Findings 47-53).

3. The renegotiation of Agreement 13904

Another uncertainty listed by the Intervenor is that the Palo Verde effluent contract (Agreement 13904) has until recently been the subject of renegotiation by the parties. The potential exists, according to the Intervenor, that possible future renegotiations might adversely affect the amount of effluent which is to be suppplied to Palo Verde. We cannot agree. There is no compulsion for Applicants to jeopardize this supply,

since there is no provision in Agreement 13904 which permits the contract to be renegotiated. Any adjustments to the present contracted amounts of effluent would presumably only take into account amounts in excess to that which is necessary for Palo Verde. (Findings 78-81)

4. Water quality issues

The Intervenor also alleged that there are certain problems with respect to water quality that could adversely affect Palo Verde's effluent supply needs. One water quality issue was advanced by Intervenor's witness William Lorah who contended that the amount of effluent necessary for the Palo Verde Units may be underestimated. He first predicted that water quality in the Phoenix area will deteriorate in the future and he then concluded that this poorer quality water will in turn result in a poorer quality effluent that will cause the Palo Verde cooling system to use more effluent than expected. This speculative assertion must fail since Mr. Lorah did not establish to what extent, if any, Phoenix area water quality will deteriorate in the future and he failed to take into account that the Palo Verde Water Reclaimation Facility and Circulating Water System have the capability to treat the deteriorated effluent to acceptable levels. (Findings 96-99).

The second claim regarding water quality was made through Intervenor's witness, William Robinson, who questioned whether the Palo Verde Water Reclamation Facility and Circulating Water System can operate properly to achieve 15 cycles of concentration in the circulating water system (and thus not require additional effluent than presently projected). Contrary to this speculative assertion, the ability of the

circulating water system to operate at even 20 cycles of concentration without excessive scaling, fouling or corrosion has been established in a number of reliable ways. First, during the years 1973-74 the Applicants performed various tests for this purpose and built a circulating water test facility at the 91st Avenue plant which simulated the Palo Verde circulating water system for tube flow velocity, temperature, and water chemistry. To confirm the velocity of the pilot plant tests, Applicants also performed a laboratory bench scale test program in California. The pilot plant test and the bench scale tests verified that the Palo Verde circulating water system could function properly at up to 20 cycles of concentration and that titanium could be reliably used for the condensor tubes at Palo Verde for resisting corrosion. (Bingham-Tr. 2587, Finding 105). Second, the circulating test procedures and results were reviewed and confirmed by an independent consultant. (Bingham-Tr. 2587, Finding 106). And third, the data from operating experience at other electric generation power plants confirmed that municipal waste water can be used for cooling, that operating cycles or factors of concentration can be achieved at 10 to 40 cycles, and that titanium condensors can perform satisfactorily. (Bingham-Tr. 2588, Findings 109-112).

Intervenor's Witness Robinson's main criticism of the circulating water tests was that the circulating water facility pilot plant was too undersized to accurately depict the performance of the full scale facility. His other criticisms primarily consisted of various alleged errors and discrepancies in Applicants' test data. However, these criticisms by Mr. Robinson fail to establish that the operational facility cannot operate as intended. On the contrary, the validity of

Applicants' tests have been established by the operational experience of many other power plants. Furthermore, in regard to the sizing of the test facility, it was never intended by the Applicants that the test facility be an actual model for the operational facility since scale tests were not necessary. (Finding 109).

V. THE APPROPRIATE LEGAL STANDARD

As previously discussed, the Intervenor's basic argument in this proceeding is that the Palo Verde units should not be allowed to operate as long as there are uncertainties with respect to the Phoenix area's future water supplies which may at some later date create a need to invoke Section 21. This Board concludes that there is no legal basis for such an approach.

First of all, there is no safety concern in this proceeding. In the event of a cooling water shortage caused by a loss of effluent from the 91st or 23rd Avenue Plants, the Palo Verde reactors can be safely shut down by the facilities' ultimate heat sinks. (Finding 132). Insofar as environmental matters are concerned, under the National Environmental Policy Act (NEPA) there is no legal basis for refusing Palo Verde an operating license merely because some environmental uncertainties may exist with respect to Palo Verde's future effluent supply. Where environmental effects are remote and speculative, agencies are not precluded from proceeding with a project until all uncertainties are removed. State of Alaska v. Andrus, 580 F.2d 465, 473 (D.C. Cir. 1978) vacated in part, sub nom., Western Oil and Gas Association v. Alaska, 439 U.S 922 (1978); NRDC v. Morton, 458 F.2d 827, 835, 837-838 (D.C.

Cir. 1972). Moreover, moot or farfetched alternatives need not be considered under NEPA. See Vermont Yankee Nuclear Power Corp v. Natural Resources Defense Council, 435 U.S. 519 (1978); Natural Resources Defense Council v. Morton, 458 F.2d 287, 837-838 (D.C. Cir. 1972); Life of the Land v. Brinegar, 485 F.2d 460 (9th Cir. 1973), cert. denied, 416 U.S. 961 (1974).

The alleged environmental uncertainties complained of by the Intervenor are speculative and conjectural for the reasons set forth above which, in general, include the fact that:

a. they are directly refuted by the testimony of knowledgable witnesses who believe the Phoenix area will have an adequate water supply;

b. they fail to take into account that there are a number of ways the Cities can obtain additional water in the future to offset any potential losses;

c. they fail to take into account that the Palo Verde Units may be able to obtain other sources of cooling water if necessary;

d. the Intervenor for the most part has failed to provide any reasonable analysis or basis for determining when such uncertainties will occur, the amount of water that could potentially be lost if the alleged uncertainties in question do occur, and finally, whether the amount of water that could potentially be lost could cause a water shortage in the Phoenix area.

Environmental uncertainties raised by Intervenors in NRC proceedings do not result in a per se denial of the license, but rather are subject

to a rule of reason. The test cited by the Appeal Board in Northern States Power Company (Prairie Island Nuclear Generating Plant, Units 1 and 2), ALAB-455, 7 NRC 41 (1978) is not whether the uncertainty is "theoretically possible" but rather ". . . whether it is reasonably probable that the situation will obtain." (Id., at 48). The Licensing Board in Dairyland Power Cooperative (La Crosse Boiling Water Reactor), LBP-82-58, Slip Opin. p. 22 (August 2, 1982) has recently followed the Prairie Island test in dismissing a contention it considered to be too remote and speculative.

The "reasonable probability" test established in Prairie Island is substantially similar to the test used by the Licensing Board in Public Service Company of Oklahoma (Black Fox Station, Unit 1 and 2), ALAB-573, 8 NRC 102, 120 (1979), where a Licensing Board decided there need only be a "reasonable assurance" that a nuclear facility would have sufficient cooling water. Black Fox is on all fours with the situation here because both cases deal with the adequacy of cooling water supply. If anything, the cooling water availability in Black Fox was much more tenuous than here because the City of Tulsa had the right to terminate its water supply contract for the reactor at will. Moreover, the contention in Black Fox challenged the adequacy of coolant for the entire life of the plant as opposed to the situation challenged in Contention 5 which is limited to the first five years of the units' operations. Despite the fact that there were a number of uncertainties, the Black Fox Board found there was "reasonable assurance" that the Applicant would obtain sufficient water. This Board likewise concludes that the proper test for

cooling water availabiiity should be whether there is a "reasonable assurance" of its availability.

As part of the Intervenor's rigid approach regarding effluent sufficiency, she would also assume for purposes of calculating the required effluent that the Palo Verde facility be operational almost one hundred percent of the time without any down time allowed for temporary effluent shortage. She bases this standard on the testimony of her witness, Mr. William Lorah, who stated that there should be an assured full supply of cooling water for Palo Verde more than ninety-five and as close to one hundred percent of the time as possible. The basis for Mr. Lorah's opinion was that there may be adverse economic affects if Palo Verde is not always in operation. (Lorah-Tr. 1474-1475, 1522, 1526-1527).

We cannot agree with this argument. Although it would be best from an economic viewpoint for Palo Verde to be operational one hundred percent of the time, this does not mean that the Palo Verde facility, which is substantially completed, should not receive an operating license if there is the possibility that it may not be able to operate full time in the future for any reason. As substantiated by the Palo Verde FES which lists great economic advantages by allowing Palo Verde to operate (Staff Ex.-1, p. 2-2), it is obvious that some return on investment is better than no return at all.

The Intervenor's economic arguments are also incorrect as a matter of law. Originally, Congress was not concerned that this Agency assess whether a proposed nuclear plant would be the most financially advantageous way for a utility to satisfy its customers' needs for power.

This Agency's involvement in financial matters was limited to determining whether applicants were able to build and operate a plant without compromising safety because of pressing financial needs. With the passage of NEPA, cost benefit balancing is now required, but only if the proposed nulcear plant has environmental disadvantages in comparison to possible alternatives. Consumers Power Co. (Midland Plants, Unit 1 and 2), ALAB-458, 7 NRC 155, 162 (1978). See also: Public Service Co. of Indiana, Inc. (Marble Hill Nuclear Generating Station, Units 1 and 2), ALAB-339, 4 NRC 20, 48 (1976); Tennessee Valley Authority (Hartsville Nuclear Plant, Units 1A, 2A, 1B, 2B), ALAB-367, 5 NRC 92, 102-03 (1977); Illinois Power Co. (Clinton Power Station, Units 1 and 2), ALAB-340, 4 NRC 27, 48 (1976). This cost benefit comparison has been limited further by the Commission's recent amendment to 10 C.F.R. Part 51 which precludes alternative energy source issues from being considered in operating license proceedings. 47 Fed. Reg. 12940 (March 26, 1982). Under this recent amendment to Part 51, the Intervenor is estopped from arguing that there are alternative energy sources which are superior to Palo Verde. She is also precluded from asserting arguments regarding what percent of the time the plants should be operational. Except to the extent they are included in comparisons of possible alternative energy sources or they bear upon the Applicants' ability to safely operate the plant, economic considerations of this nature are not reviewable by this Agency. This Agency's regulatory authority does not extend to the oversight of applicant's business judgments. Northern States Power Co. (Prairie Island Nuclear Generating Plant, Units 1 and 2). ALAB-244, 8 AEC 857, 862 (1974).

VI. LAWSUITS POTENTIALLY AFFECTING THE PALO VERDE EFFLUENT SUPPLY

Immediately prior to and during the hearing, the Intervenor tried to interject as an issue in this proceeding certain cla[illegible]s made in a suit filed on January 18, 1982 in the United States District Court for the District of Columbia (Civil Action File No. 82-0145) by the Salt River Pima-Maricopa Indian Community against the United States and James Watt, Secretary of the Interior. The question presented in that lawsuit, as it applies to the Palo Verde Units, is that the Cities who are signatories to Agreement 13094 may not have the legal right to sell this effluent to the Applicants since this effluent is subject to Indian Claims and Bureau of Reclamation Control. This Board declined to consider the issues related to the Pima-Miracopa lawsuit on the basis that the NRC is not obliged under NEPA to consider all issues which are currently the subject of litigation in other forums and which some day in the future might have an impact on the amount of effluent available to Palo Verde. (Tr. 1629; Board Order of June 14, 1982, Slip Opinion at pp. 2-4).

We reiterate that the Indian Water rights matters encompassed in the Pima-Miracopa Indian lawsuit is not a proper issue in this proceeding. The District Court has jurisdiction to enforce Indian water rights and this forum does not. Even if we had agreed to receive evidence on these issues, we would still be merely guessing what the outcome of the District Court case would be. In addition to needing to know what the outcome of the Appeal Board decision would be to insure that our decision would be a correct one, such guessing would also not be appropriate since, as the Appeal Board has stated in the context of a construction permit proceeding, if a Licensing Board is ". . . obliged to factor into

its consideration of an application for a construction permit every possible in futuro ruling of a federal or state regulatory body, its undertaking would be virtually endless." Southern Califorina Edison Co. (San Onofre Nuclear Generating Station, Units 2 and 2), ALAB-189 7 AEC 410, 412 (1974). This same reasoning applies to an operating license case, as here, and the issues in the Pima-Maricopa proceeding.

In addition to not attempting to rule upon the issues involved in Indian water rights, it would also be wrong for this Board to prevent the Palo Verde Units from operating until the issues in the Pima-Maricopa lawsuit are resolved. Although this Agency will take cognizance of activities before other legal tribunals when the facts so warrant, it should not delay its licensing proceedings or withhold a license merely because some other legal tribunal might conceivably take future action which may later impact upon the operation of a nuclear facility. Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), CLI-78-14, 7 NRC 952, 958 at fn. 5 (1978), Wisconsin Electric Power Co. (Koshkonong Nuclear Plant, Units 1 and 2), CLI-74-45, 8 AEC 928, 930 (1978), Southern California Edison Co. (San Onofre Nuclear Generating Station, Units 2 and 3), ALAB-171, 7 AEC 37, 39 (1974); and Cleveland Electric Illuminating Co., (Perry Nuclear Power PlaNT, Units 1 and 2), 6 NRC 741, 748 (1977). The outcome in the Pima-Maricopa lawsuit proceeding, as it might affect Palo Verde, is most speculative since there is no way of predicting how that proceeding would affect the Palo Verde effluent supply. In addition, many years may expire before that litigation is resolved.

VII. NEPA CONSIDERATIONS

At the end of the second week of the Palo Verde operating license hearing, the Intervenor for the first time contended that this Board had a duty under NEPA to consider cost benefit questions regarding Contention 5. At that time she specifically attempted to question her witness about costs for alternative cooling water supplies if the Palo Verde effluent is not available. (Tr. 1440, 1463). This Board ruled that this line of questioning is beyond the scope of Contention 5. (Tr. 1440). Contention 5 is solely concerned with whether there is an assured source of effluent for Palo Verde.

Except perhaps in the case of sua sponte [2/] consideration of an issue, before a Board will consider cost balancing determinations at the operating license level of review, such questions must be properly placed in issue by a party and admitted as a contention. The Intervenor never attempted to add this question until well into the hearing. No good cause was furnished by the Intervenor as to why this matter was first raised at that late date. Moreover, the remaining factors of 10 C.F.R. § 2.714 concerning late filed contentions were never addressed by the Intervenor and accordingly the Intervenor failed to meet the burden placed upon her by the Regulations to have this matter raised at such a late date.

The Staff has already made its cost benefit balancing of the Palo Verde Units Table 2.1 (page 2-2) of the FES demonstrates that there will be a savings in the year 1987 of 1,900 million dollars by having the three Palo Verde Units operational as opposed to having to buy

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2/ See Cincinnati Gas and Electric Co. (Zimmer Nuclear Power Station, Unit No. 1), CLI-8-20, Slip Opinion (July 30, 1982); Texas Utilities Generating Co. (Comanche Peak Units 1 & 2), CLI-81-36, 14 NRC 1111, 1113-1114 (1981).

replacement power. The FES also includes in its analysis the determination that the Palo Verde station ". . . has already been essentially constructed" and ". . . the economic and environmental costs associated with the construction of the station that have been incurred must be viewed as sunk costs in any prospective assessment." (Staff Ex. -1, p. 3-1). As reflected by these determinations in the FES, if Palo Verde does not receive its operating license and is forced to stand idle, as the Intervenor recommends, there will be huge economic losses. On the other hand, even if the units at a later date are forced to shut down by not receiving sufficient effluent, there will at least have been the economic benefit of being able to operate during the interim period. Thus, since the "environmental costs" are already sunk costs, the FES clearly demonstrates that the environmental cost benefit balancing greatly weighs in favor of granting the Palo Verde license.

The Intervenor's NEPA cost benefit arguments are also inappropriate because they include alternative energy source issues. (Tr. 1463, lines 11-12). Such arguments are precluded by a new Commission Rule amending 10 C.F.R. Part 51, effective April 26, 1982, which provides that, for purposes of the National Environmental Policy Act (NEPA), need for power and alternative energy source issues are not to be considered in operating license proceedings for nuclear power plants. 47 Fed. Reg. 12940.

VIII. CONCLUSION (OPINION SECTION)

There is no safety issue in this proceeding since, in the event of a cooling water shortage, the Palo Verde reactors can be safely shut down by the facilities' ultimate heat sinks. (Finding 132). The only remaining issue relative to the supply of effluent is therefore environmental.

One of the Intervenor's main arguments is that future water supply uncertainties could cause a water shortage in the Phoenix area, thus permitting Cities to withhold effluent intended for Palo Verde by invoking Section 21 of Cities effluent contract with the Applicants. However, the Intervenor never specifically established how much water these uncertainties might cause the Phoenix area to lose or whether such amounts of lost water would be enough to cause a water shortage. The Intervenor's speculative analysis also failed to take into account that there are a number of ways the Cities can obtain additional water in the future to offset losses from the Intervenor's alleged uncertainties, including such measures as purchasing groundwater rights from others, condemnation of existing Colorado River rights, and water conservation measures. (Finding 28). It should further be emphasized that the chances of Intervenors' alleged uncertainties ever substantially adversely affecting the Phoenix area water supply would appear to be minimal in view of Messrs. Steiner's and Juetten's credible testimony that the area would have adequate water availability in the future. For these reasons, the record in this proceeding fails to establish a reasonable likelihood that such alleged uncertainties will occur or

assuming that they did, that they would be of sufficient magnitude to enable Cities to invoke Section 21.

Based on these considerations, we find that none of the matters raised by the Intervenor establish that there is not a reasonable assurance that the effluent supply for Palo Verde will be available during the first five years of its operation, or for that matter, during the entire operating life of the facility. It is well established that where environmental effects are remote and speculative, as they are in this case, agencies are not precluded from proceeding with a project until all uncertainties are removed. State of Alaska v. Andrus, supra, 580 F.2d at 473; NRDC v. Morton, supra, 458 F.2d at 835, 837-838. In addition, in regard to the possibility of future adverse contingencies, a license should not be withheld on the basis that it may later have to be modified. See e.g.: Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), CLI-77-8, 5 NRC 503, 509-510.

Furthermore, not only is it most unlikely, based upon the evidence of record, that Palo Verde will lose its effluent supply, it is also important to consider that any loss of effluent might only be temporary. Under these circumstances, the question narrows to one of economics and whether the Palo Verde facility should receive its license if it will not be operational one hundred precent of the time. As we have discussed, this Agency will not substitute its economic judgment for that of the Applicant with respect to matters that have no safety and little or no adverse environmental condequences. Northern States Power Co., supra, 8 AEC at 857. There are no safety concerns in this proceeding and, as discussed supra, an environmental balancing weighs heavily in favor of

allowing the facility to operate. Regarding environmental concerns, any adverse impact would be minimal since the facility is substantially completed. On the other hand, if the facility is not allowed to operate, there will be large economic losses. Moreover, an environmental comparison is not even necessary in this case since cost benefit balancing is only required if a proposed nuclear plant has environmental disadvantages in comparison to possible alternatives. Consumers Power Co., supra, NRC at 162. Because this is an operating license proceeding, however, cost balancing regarding alternative energy sources is no longer required under the new Commission Rules amending Part 51. 47 Fed. Reg. 12940 (March 26, 1982).

For all of the above stated reasons, this Board concludes that the Palo Verde facility should receive its operating license.

FINDINGS OF FACT

1. The Palo Verde Nuclear Generating Station Unit 1 is scheduled for commercial operation in 1983, Unit 2 is scheduled for commercial operation in 1984, and Unit 3 is scheduled for commercial operation in 1986 (Hulse-Tr. 404, affidavit pp. 1-2).

2. Intervenor's Contention 5 is that Applicants will not have an assured supply of usable treated municipal effluent for cooling purposes for Palo Verde Units 1, 2 and 3 during months of peak reactor need for the first five years of operation. This contention

includes the question of whether a greater amount of effluent will be necessary for the Palo Verde units if there is a poorer quality of effluent than that which is presently expected. It also includes whether there is any safety question with respect to the effluent (Tr.-329-358).

I. The Palo Verde Effluent Supply

3. Palo Verde Units 1, 2 and 3 will obtain municipal effluent for cooling purposes under an April 23, (1973) contract, entitled "Agreement No. 13904," between two of the Joint Applicants [Arizona Public Service Company ("APS") and Salt River Project Agricultural Improvement and Power District ("SRP")] and the Cities of Phoenix, Glendale, Mesa, Scottsdale, Tempe, Arizona (hereinafter collectively referred to as "Cities") and the town of Youngstown, Arizona. (JAE-H, p. 1) Another source of cooling water for these Palo Verde units will be sewage effluent from the City of Tolleson's waste water treatment plant. (Muir-Tr. 1034-1035, JAE-J).[3/] Agreement No. 13904 was effective at the time it was executed by the parties and it shall not terminate until forty years after the last Palo Verde unit has been placed in operation, but in no event later than the year 2040 (JAE-H, p. 3).

3/ In these findings, Joint Applicant's exhibits are designated as "JAE", Intervenor's exhibits as "IE", and Staff Exhibits as "Staff Ex.".

4. The primary source of cooling water to be obtained under Agreement 13904 will be sewage effluent from the City of Phoenix's 91st Avenue Sewage Treatment Plant ("91st Avenue Plant") (Hulse-Tr. 404, affidavit p. 2; JAE-H, p. 14).

5. A secondary source of cooling water under Agreement 13904 will be sewage effluent from the City of Phoenix's 23rd Avenue Treatment Plant ("23rd Avenue Plant"). If the amount of effluent from the 91st Avenue Plant is insufficient to meet the requirements for Palo Verde, then Argeement 13904 provides for use of effluent from the 23rd Avenue Plant. (JAE-H, p. 14; JAE-B, p. c-2; Hulse-Tr. 464, 472).

6. The City of Phoenix owns and operates the 23rd Avenue Plant. The other Cities that are signatories to Agreement 13904 share ownership with the City of Phoenix in the 91st Avenue Plant, although this plant is soleiy operated and maintained by the City of Phoenix. (JAE-H, p. 1).

7. The treatment capacity of the 91st Avenue Plant is currently 90 million gallons per day (mgd). By the middle of 1983, its capacity will be enlarged to 120 mgd. The capacity of the 23rd Avenue Plant will be upgraded to handle 37.2 mgd. (McCain-Tr. 2275-2278; JAE-KK, p. 2-26). There is a pipeline between the 23rd Avenue Plant and the

91st Avenue Plant whereby sewage that might be treated at the 23rd Avenue Plant can be transported to the 91st Avenue Plant for treatment. (McCain-Tr. 2279). There is a 36.5 mile underground pipeline from the 91st Avenue Plant to the Palo Verde site for transporting effluent. (Hulse ff. Tr. 404, p. 2).

8. Another source of cooling water for PVNGS will be sewage effluent from the City of Tolleson's waste water treatment plant. The capacity of Tolleson's sewage treatment plant is 9,300 acre feet per year (afy). It is currently treating 6,400 afy and it is estimated that in 1986 it will be treating 8,400 afy. (Muir-Tr. 1034-1035) According to the terms of its contract with APS and SRP, Tolleson has agreed to sell these two members of Applicants all of its surplus effluent, not to exceed 8.3 million gallons per day (mgd) (JAE-J, Hulse-Tr. 404, pp. 5-6.) Presently Tolleson effluent discharges into the Salt River. Later it will be discharged directly into the Palo Verde pipeline. (Muir-Tr. 1054).

9. Pursuant to Agreement No. 13904, APS and SRP may take up to 140,000 afy of effluent from the 91st and the 23rd Avenue Plants subject to the availability of such amounts after satisfaction of prior commitments. (JAE-H, pp. 8-9; JAE-B, p. C-2; Hulse-Tr. 463). Prior commitments from the 91st Avenue Plant are approximately 38,500 afy to the Buckeye Irrigation Company, 7,300 afy to Arizona Game and Fish Department and 1,200 afy to the U.S. Conservation Lab. (JAE-H, exhibit A; Hulse-Tr. 466-467; Shaper-Tr. 806, JAE-R). The

prior commitment of 1,200 afy to the U.S. Water Conservation Laboratory has not been used since 1978 when the laboratory's research facility at Flushing Meadows was washed out by flood waters and the facility has now been moved and is no longer taking any effluent from the 91st Avenue Plant. (Hulse-Tr. 404, affidavit p. 4; Tr. 466-467). With respect to the 23rd Avenue Plant, the Roosevelt Irrigation District has an option for 20,000 afy of 23rd Avenue effluent but this requirement is secondary to the Palo Verde commitment. An undetermined amount of effluent from the 23rd Avenue Plant is taken by McDonald Farms, a private farming operation. (JAE-B, p. C-2).

10. In 1979 the Maricopa Association of Governments (MAG) completed a three year waste water planning study (funded and prepared by EPA and the U.S. Corps of Engineers) which includes waste water flow projections from sewage treatment plants in the Phoenix metropolitan area. These MAG projections were later updated in September 1981 and May 1982. (JAE-F, G and MM; Hulse-Tr. 441). Waste water flow projections were also made by the City of Phoenix in 1972, 1977, 1978, 1979, 1980, 1981 and 1982. (JAE-G) The MAG estimates are more conservative than the City of Phoenix estimates in projecting the amount of uncommitted effluent which will be available from the 91st Avenue Plant (JAE-G).

11. In determining cooling water requirements for Palo Verde, during the first five years of operation, June 1986 is the most

critical time frame to examine. This is so since the year 1986 is when Unit 3 first comes into commercial operation and June is the month of expected peak reactor needs based upon historic atmospheric data. (Gonzales-ff. Tr. 2522, p. 2; ER-OL Section 3.4-1).

A. The Adequacy of Palo Verde's Effluent Supply as Determined by Staff Witness Gonzales

12. Staff witness Gonzales determined that in June of 1986 there will be an ample supply of effluent available from the 91st Avenue Plant alone, without any contributions from the 23rd Avenue Plant or Tolleson, to meet the cooling water needs of the three Palo Verde units. To arrive at these conclusions, Mr. Gonzales' analysis utilized both MAG 208 and City of Phoenix projections of effluent availability from the 91st Avenue Plant. His computations included use of the Greely and Hansen study to arrive at monthly breakdowns of effluent flow projections. With respect to the more conservative 1981 MAG 208 Revised Projections (the most recent MAG 208 projections at the time Mr. Gonzales made his analysis), he calculated that in June 1986 the 91st Avenue Plant would produce about 71.3 mgd of effluent after first priority commitments to Buckeye Irrigation District and Arizona Game and Fish Department of 35.3 mgd had been subtracted. With respect to the 1981 City of Phoenix Study, he calulated that there will be 86.7 mgd of uncommitted effluent for Palo Verde in June 1986. (Gonzales-ff. Tr. 2522, pp. 6-9). Mr. Gonzales concluded that using

both the 1981 MAG and 1981 City of Phoenix study, there will be sufficient effluent in June 1986 for all three Palo Verde units, based on the projected cooling water requirements during this period for these units of 70.2 mgd.

13. Witness Gonzales' analysis was based upon the latest MAG 208 and City of Phoenix projections that were available at the time that he filed his testimony in this proceeding. Between the period when he filed his testimony and the time he testified, the 1982 MAG 208 Update became available. This updated study did not adversely affect the conclusions in his prefiled testimony concerning effluent availablity for Palo Verde, however, since it showed that there would be an even greater amount of effluent produced by the 91st Avenue Plant. (Gonzales-Tr. 2524; Hulse-Tr. 445; JAE-F). The 1982 MAG 208 Update thus adds to the conservatism of Mr. Gonzales' analysis. Mr. Gonzales determinations are also conservative since he does not include effluent available from the City of Tolleson or from the 23rd Avenue Plant. (Gonzales ff.-TR.2522, p. 10)

B. The Adequacy of the Palo Verde's Effluent Supply as Determined by Applicants' Witness Hulse.

14. To demonstrate there will be enough effluent available for the Palo Verde units, Applicant's witness Mr. Richard Hulse, prepared a graph depicting the effluent availability from: (1) the 91st Avenue Plant and (2) the 91st Avenue Plant plus the Tolleson plant.

Mr. Hulse then compared these amounts with the amount of effluent needed to operate the Palo Verde units at 87.5% and 75% capacity factors. (JAE-A; Hulse-Tr. 405, 408, 419-421, 493, 597). This graph establishes that the 91st Avenue Plant alone is sufficient to meet Palo Verde effluent requirements for the entire period 1985 through 1987, to include the most critical month for Palo Verde's needs which is June 1986. (JAE-A; Hulse-Tr. 431)

15. Mr. Hulse's analysis has a conservative basis because its projections come from the 1979 MAG 208 Study which has the lowest effluent projections for the 91st Avenue Plant of any MAG 208 or City of Phoenix study made since 1977. (JAE-A; Hulse-Tr. 431). If Mr. Hulse had used the City of Phoenix's projections, the margins for which there would be water in excess of Palo Verde needs would have been considerably increased (Hulse-Tr. 431). The 1979 MAG study was also demonstrated to be conservative because actual discharges from the 91st Avenue Plant in 1981 were significantly more than the 1979 MAG projections (Hulse-Tr. 432-438; JAE-C and E).

C. Other Indications Attesting to the Adequacy of the Palo Verde Effluent Supply.

16. Also reinforcing the testimony of Messers. Gonzales and Hulse was the fact that in June 1981 a total of 2154 afy (per unit) of effluent was processed at the 91st Avenue and Tolleson plants. This is approximately the same amount of effluent as the 2177 acre feet

per unit of effluent, as projected by Mr. Hulse, that will be required during June 1986 when all three Palo Verde units will be operating. (JAE-E; Hulse-Tr. 438-441).

17. The 1982 MAG 208 update further confirms the conservatism of witnesses Hulse and Gonzales testimony regarding effluent projections. This study, which is the most current projection of effluent projection from the 91st and 23rd Avenue Plants, indicates that in 1985, at the time that two Palo Verde Units are on line, there will be 125 mgd of effluent available and only 38.7 mgd required for Palo Verde. In 1990, when all three Palo Verde units are in operation, there will be 125 mgd available for Palo Verde and only 58 mgd actually used. (JAE-F, Table IV-1; Hulse-Tr. 445-446; JAE-LL, p. I-1; McCain-Tr. 2285-2287). The 1982 MAG 208 update is based upon conservative estimates since it includes allowances for water conservation measures. (McCain-Tr. 2293-94).

18. The effluent supply scheduled for Palo Verde was also confirmed to be adequate by the testimony of Intervenor's witness, Mr. Robert McCain, Staff Director of the Arizona Municipal Water User's Association. Mr. McCain testified that he believed the City of Phoenix projections of effluent from the 23rd and 91st Avenue Plants will prove to be generally accurate. (McCain-Tr. 2326). Mr. McCain also acknowledged that the City of Phoenix's projections of effluent to be available for 1985 from the 91st Avenue plant was 128.1 mgd and that subtracting the total prior commitments to the Arizona Game

and Fish and Buckeye Irrigation of 33.3 mgd would leave 94.8 mgd of effluent to satisfy the Palo Verde commitment. This amount is approximately 36 mgd in excess of the requirements for the Palo Verde units. (Tr. 2326-2334).

II. The Adequacy of the Future Water Supply in the Phoenix Metropolitan Area

19. The Intervenor in this proceeding has attempted to discredit the reliability of the future water supply in the Phoenix area in order to show that there is not an assured source of cooling water for the Palo Verde units. To adequately address her arguments (See page 42 et. seq.), it is first necessary to outline the water supply situation in the Phoenix, Arizona metropolitan area. The Phoenix area is the area of concern in this proceeding since this is where the cities, which are signatories to Argeement 13904 that will supply water effluent for the Palo Verde units, are located. (JAE-H, p. 1).

A. Current Water Supplies in the Phoenix Area

1. Areas Served by Salt River Project

20. One of the main suppliers of water in the Phoenix area is the Salt River Project (SRP), a municipal corporation, which among other

things, acts as an agent in delivering surface water and groundwater to members lands within its boundaries. (McCain-Tr. 2394). The surface water resources of the SRP include the drainage area of the Verde River, the Salt River and Tonto Creek. (Juetten-Tr. 636). Groundwater resources of SRP include 249 active deep well pumps (Juetten-Tr. 619, 637). Its member's lands consist of 238,000 acres, 100,000 of which are agricultural and the remainder are urbanized into the communities of Phoenix, Glendale, Peoria, Tempe, Mesa, Chandler, Gilbert and Tolleson, Arizona. (Juetten-Tr. 634; McCain-Tr. 2394). SRP distributes water in the following manner. In the State of Arizona the right to surface water is vested in the land itself which is entitled to receive SRP water as long as assessments are paid. SRP, as agent of these lands, catches surface water which is owing these lands as it flows down the Salt and Verde Rivers and stores it in dams. The water in the dams is then eventually delivered to member lands through canals. Often this water is first delivered for treatment to municipalities who are also acting as agents for the land owners. (McCain-Tr. 2394-2398; Juetten-Tr. 645 - 646). Although the SRP was originally intended to be a water program for agricultural use, considerable SRP water has been transferred to urban use. Such transfers are permissible since Arizona land retains water rights regardless of its use. (Id.)

21. The Cities of Tempe, Mesa, Glendale, and Phoenix are served by SRP surface area water and they also have a number of ground water wells of their own (Juetten-Tr. 645, 653-654, 655, 657-660,

690-691). The City of Scottsdale is served by its own wells and by the City of Phoenix (Juetten-Tr. 656).

2. Areas Outside the Salt River Project

22. The City of Scottsdale is entirely outside the SRP boundary and portions of the Cities of Phoenix, Tempe, Glendale and Mesa are also located outside this boundary (Juetten-Tr. 652-659, 640, 643-644). When Cities expand their boundaries outside of the SRP boundaries, they must develop their own water supplies to serve those areas. (Juetten-Tr. 644). There is a prohibition from Cities taking water out of the Salt River boundaries without replacing it. (Juetten-Tr. 644, 731-732).

23. The Cities of Tempe, Glendale, and Mesa supply their off-SRP project areas by obtaining groundwater from their own wells (Juetten-652-655). Scottsdale obtains water from its own wells and in addition receives some of its water supply from the City of Phoenix. (Tr. 656-657). Scottsdale presently has 19 wells, Tempe has 9 wells, Mesa has 22 wells and Phoenix has 130 wells (McCain, Tr. 2350). The City of Phoenix supplies its off-project areas from its own wells and also obtains additional water by its receipt of "gate water credits" which entitles it to Verde River surface water. Phoenix earned this entitlement by paying $800,000 for the construction of gates at the Horse-Shoe Dam. Gate water credits are

accumulated by Phoenix when the flow of the Verde River rises to a point at the dam where it is trapped behind the gates. (Juetten-Tr. 660-661, 684-685, 726-728 McCain-Tr. 2350). As of April 1, 1982, the City's gatewater balance was 88,811 acre feet. Phoenix is free to use this water inside or outside the SRP boundaries, but it uses most of it outside (Juetten-Tr. 663-664).

B. Future Water Supplies for the Phoenix Area

24. In addition to SRP surface water and groundwater supplies that Cities are presently obtaining, there are a number of additional water sources which will be available in the Phoenix area in the future. These include:

(1) The Central Arizona Project (CAP)

25. The Central Arizona Project (CAP) is a federal reclamation project which was authorized by Congress and signed into law in 1968. Its purpose is to develop and bring into Arizona the State's remaining entitlements to Colorado River water under a decree of the U.S. Supreme Court in Arizona v. California. (Steiner-Tr. 741). As part of that settlement, Arizona is to receive 2.8 million acre feet of Colorado River water plus any surplus above 7.5 million acre feet. The State of Arizona currently uses or has committed to use about 1.2 afy for use along the Colorado River, primarily for

agricultural purposes. (Id,-Tr. 741, 742). It is proposed that most of the remaining 1.6 million afy be brought into the Phoenix and Tucson area and the agricultural area that lies between these two metropolitan areas. (Id,-Tr. 742).

26. The construction of the CAP has been in progress and is moving well along. An aqueduct system is being constructed that has 12 reaches. Nine of these reaches have already been completed. The project will probably be completed and will be able to deliver water in the Phoenix metropolitan area by 1985. (Id,-Tr. 743, 745, 794). It is estimated that the final reach of the Tucson aqueduct will be completed in 1989 or 1990. (Id,-Tr. 744).

27. The water from CAP is to be allocated among various categories of users to include Indian use, municipal industrial use, pure industrial use (basically power utilities and mines), agricultural use and to a very limited extent recreational use. (Id, Tr. 746, 773-776). The only lands in the Phoenix area where CAP water is scheduled to be delivered are those outside the SRP boundaries. SRP lands will not receive this source of supply since it has been determined that they will have sufficient water due to continued urbanization and the abundancy of SRP surface water (McCain-Tr. 2358).

The Secretary of Interior has ultimate responsibility for allocating the quantities of water to be received by the users, but as a practical matter, with the possible exception of Indian

allocations, the State of Arizona through its Department of Water Resources will be allowed to decide most of these allocations, (Steiner-Tr. 747; JAE-Q, p. 1). An Environmental Impact Statement has been proposed by the Department of Interior which contains six different options for allocating water used by the various categories of users. (JAE-Q). The recommended option by the Secretary is Option Number Six which allocates 309,828 afy to 12 Indian tribes and 638,824 afy to 85 municipal and industrial entities and the remaining supply to various agricultural operations (JAE-Q, summary section p. 3). The recommendations in this statement compare favorably with recommendations that the State of Arizona has sent to the Secretary (Steiner-Tr. 747-748).

28. (2) Additional Well Construction by the Cities (McCain-Tr. 2179).

(3) Purchasing from Others the Right to Withdraw Groundwater.

The Cities expect to be able to purchase groundwater in areas which are outside the active management areas that are covered by the Groundwater Management Code. Cities also intend to purchase groundwater from areas some distance from Maricopa County and transport this well water by means of CAP aqueducts (McCain-Tr. 2179-2180).

(4) Condemnation of Existing Water Rights Along the Colorado River.

Arizona lands along the Colorado River are presently only using about 1.2 million afy of a total entitlement of 2.2 million afy of

Colorado River water. As agriculture is being phased out of areas where these water rights exist, it will be possible for Cities to purchase these rights (McCain-Tr. 2180).

(5) The Purchase of Water Rights from Agricultural Users.

As agricultural lands continue to go out of production, the Cities will be able to obtain additional water by purchasing the water rights for these lands (McCain-Tr. 2379).

(6) Water Conservation Measures (McCain-Tr. 2180).

(7) The Use and Exchange of Municipal Waste Water Effluent

Cities can potentially use municipal effluent themselves or they can exchange it with others for potable water (McCain-Tr. 2181).

C. The Adequacy of Future Water Supplies in the Phoenix Area as Established by Witnesses Juetten and Steiner

29. Applicant's witness Richard Juetten has a great deal of water supply experience in the Phoenix area and he has worked with the SRP in water related matters since January 1955. He holds degrees in hydrologic and water resources engineering and is currently the Manager of Water Resources and Services for the Salt River Project, a position which includes the planning and operation of the reservior system and the ground water system (JAE-L; Tr. 618-619).

30. Mr. Juetten's analysis of the adequacy of future water supplies in the Phoenix area was separated into two parts, one dealing with the adequacy in areas which are included within the SRP reservoir district boundaries and the other dealing with the adequacy in areas outside the boundary. (Juetten-Tr. 664-665, 674; JAE-O, P).

31. As part of his analysis of water adequacy for areas located outside SRP boundaries, Mr. Juetten prepared a chart showing the effect of water usage on the City of Phoenix's off-project water supply during the years 1982 through 1985. (Jeutten-Tr. 665-666, 671; JAE-O). The information for this chart was obtained from City of Phoenix officials and from records of the SRP (Juetten-Tr. 666-668). The results of Mr. Jeutten's analysis, as reflected in this chart, is that the off-project area will have an adequate supply of water to meet its needs and have a gatewater balance of 29,000 acre feet at the end of 1985. (JAE-O; Juetten-Tr. 671-673).

32. Mr. Juetten also testified that the off-project water supplies for the Cities of Mesa, Glendale and Scottsdale would be adequate until the arrival of Central Arizona Project (CAP) water. (Juetten-Tr. 673). The CAP will be completed in the Phoenix area by the year 1985 (Steiner-Tr. 743, 745, 794). All of the water that will be obtained from CAP is designated for use in off-project SRP areas since those lands supplied by SRP are considered to have an adequate supply of water in the future (McCain-Tr. 2358).

33. With respect to the adequacy of the Cities' future water supplies within the SRP boundaries, Mr. Jeutten prepared a chart setting forth water use and water availability for those portions of the Cities of Glendale, Mesa, Phoenix, Tempe and Scottsdale that are within the SRP area (Juetten-Tr. 675-676; JAE-P). This chart demonstrates there is presently an ample supply of water in those areas. For the year 1981 there was a total of 338,007 acre feet of water available to those Cities and only 255,156 acre feet was used; in fact, none of the Cities used its full SRP entitlement in that year. (Juetten-Tr. 677; JAE-P). Because of the continuing urbanization of agricultural land (agricultural use has a higher water usage per acre than newly established urban use), Mr. Juetten expects this condition of excess resources over usage to continue into the future until some time after the year 2000 when population densities for these converted areas have increased sufficiently for water usage to reach levels similar to the present (Jeutten-Tr. 677).

34. Mr. Wesley Steiner, Director of the State of Arizona's Department of Water Resources, also believes that the Phoenix area's future water supply is adequate to meet its needs. We give much weight to Mr. Steiner's testimony because of his position as head of the State of Arizona's water resources programs and his considerable experience with the CAP and other Arizona-related water supply matters. (Steiner-Tr. 737-741; -See also Finding 64). Mr. Steiner testified that water from the Salt River Project, the Central

Arizona Project, and ground water supplies will be sufficient to meet the Phoenix area's municipal and industrial water needs for the next fifty years provided that there is an adequate conservation program. He believed that such an adequate program now exists under the new Groundwater Management Act. Mr. Steiner also pointed out that once the CAP has been completed there will be a great many opportunities to obtain additional water supplies by use of the CAP aqueduct system (Steiner-Tr. 758-759).

35. Two of Intervenor's witnesses who testified about water availability, Messrs. William Lorah and Robert McCain, attempted to discredit the testimony of Messrs. Steiner and Juetten. Although they did not specifically contend there would be water shortages, they suggested a number of uncertainties with respect to future water availability. (McCain-Tr. 2201-2202, 2226-2227, 2212, 1462-1403; Lorah-Tr. 1391, 1397, 1399, 1400; IE-XX 8.4). This Board concludes that the opinions of Mr. Steiner and Mr. Juetten are entitled to greater weight than those of Mr. McCain and Mr. Lorah regarding Phoenix area water availability. Mr. Lorah lacks the expertise of the other witnesses regarding this geographical area because he had only been employed by the Intervenor for one month prior to testifying in this proceeding and he has never before provided professional services in the State of Arizona. (Lorah-Tr. 1473). Although Mr. McCain has a background in water supply matters, he lacks the extensive experience of Mr. Steiner and may also lack some objectivity regarding this subject matter since

the AMWUA, which Mr. McCain is the Staff Director, is presently attempting to renegotiate some of the terms of Agreement 13904 with Joint Applicants (McCain-Tr. 2335-2349; 2162-2174). Mr. Juetten's opinion is entitled to greater weight than Intervenor's witnesses because, unlike Messrs. McCain and Lorah, he bases his conclusions on studies he prepared from official records (Juetten-Tr. 665-668, 675-676; JAE-O & P) rather than speculation.

III. The Intervenor's Arguments As To Why There Is Not An Assured Water Supply For the Palo Verde Units

36. In contending that there is not an assured source of water for the Palo Verde Units, one of the Intervenors' main arguments is that Section 21 of Agreement 13904 allows the municipalities to reduce the amount of effluent sold to Joint Applicants in the event of a critical need of the Cities for that water. Section 21 of Agreement 13904 provides that the Cities shall have the right to refuse delivery of effluent if: (1) there exists a critical need for water to be used for domestic purposes, (2) all other reasonable sources of water, including any uncommitted effluent in excess of the option effluent, have been exhausted, (3) reasonable steps have been taken to conserve the water supply in the Cities, and (4) reasonable notice of the critical need has been given to the participants. Section 21 also provides that when the critical need expires, or when other reasonable sources of water become available, Cities can no longer refuse to deliver effluent under the terms of the

agreement. In addiiton, it requires the Cities to use their best efforts to resume deliveries of effluent at the earliest practical time in the event that such deliveries are interrupted (JAE-H-pp. 34-35, Hulse-Tr. 469-470).

37. To show the potential for this critical need under Section 21, the Intervenor has listed a number of water supply uncertainties that she contends could cause water shortages in the Phoenix area. (IE-XX, p. 3, McCain-Tr. 2198; Lorah-Tr. 1387- 1389). She alleges that water shortages could be caused by well contamination (McCain-Tr. 2226-2227; IE-XX; p. 4, Lorah-Tr. 1391), extended drought (Lorah-Tr. 1400) restrictions on the amount of wells that can be drilled due to the Groundwater Management Act (Lorah-Tr. 1399; McCain-Tr. 2212), and a number of potential uncertainties regarding the supply of water from the Central Arizona Project (McCain-Tr. 1402-1403). If a critical need arises, according to the Intervenor, effluent needed for the Palo Verde units could be traded for potable water or it could be used by the Cities themselves. In addition, such uses of effluent in turn could create a need to build new waste water treatment facilities which are closer to where the effluent is traded or used. Such new plants could possibly diminish the amount of effluent which is available to be treated at the 91st and 23rd Avenue Plants. (IE-XX, p. 7)

38. Other uncertainties advanced by the Intervenor with respect to the Palo Verde water supply include claims in Indian lawsuits

involving the question of effluent ownership (McCain-Tr. 2216, 2230-2231; Lorah-Tr. 1437), potentially adverse effects from possible renegotiation of Agreement 13904 (IE-XX; p. 4), and potential water quality problems in the Phoenix area that may require a greater amount of cooling water to be used for Palo Verde than is scheduled to be provided. (Lorah-Tr. 1409-1410). With respect to the water quality question, the Intervenor has also questioned the ability of the Palo Verde water treatment facility to perform as intended. (Robinson-Tr. 1615, 1622, 1629, 1643, 1653, 1617-1618).

39. This Board concludes, as reflected in the following findings in Sections III-A through V, that the evidence in this proceeding fails to establish that the uncertainties raised by the Intervenor will jeopardize the effluent supply for the Palo Verde units during the first five years of operation, or for that matter, at any time in the foreseeable future.

A. Potential Problems Caused By the Construction of New Subregional and Satellite Wastewater Treatment Plants

40. The argument is made by the Intervenor that additional water treatment plants may be built in the future in the Phoenix area that could divert some of the effluent going to the 91st and 23rd Avenue Plants, thus potentially jeopardizing Palo Verde's cooling water supply. Contrary to this assertion, this Board finds that the

evidence in this proceeding establishes that new treatment plants will not cause the 91st Avenue and 23rd Avenue Plants to loose a significant amount of effluent.

41. The Maricopa Association of Governments (MAG) is a governmental body charged with, among other things, planning the waste water treatment facilities in the Phoenix metropolitan area. In behalf of MAG, the U.S. Environmental Protection Agency in July, 1979, prepared a Final Environmental Impact Statement and the U.S. Corps of Engineers prepared a MAG 208 Water Quality Management Program. In May 1982, a MAG 208 Point Source Plan Update was issued. (JAE-KK, p. iii; Steytler-Tr. 876). The Arizona Municipal Water Users Association supports MAG and its members are associated with the MAG studies. (McCain-Tr. 2302, 2304).

42. The preferred alternative in the July 1979 MAG Study was to link up many small cities with the 91st Avenue Treatment Plant. (Steytler-Tr. 879). The MAG 208 study has been updated by a May 1982 Point Source Plan. According to the May 1982 Update, the 91st Avenue Plant will continue to be the main regional wastewater treatment facility. (JAE-LL; p. III-1; McCain-Tr. 2301).

43. The 1982 MAG Update for the first time allows the Cities to build subregional plants (JAE-LL; p. III-23; McCain-Tr. 2416-2417). However, this should not adversely affect the amount of effluent going to the 91st Avenue Plant. The Cities still must purchase

necessary capacity at the 91st Avenue Plant (Steytler-Tr. 885-887). In addition, although these new treatment plants potentially may divert some effluent from the 91st Avenue Plant, the 1982 MAG update shows there will still be an ample amount of effluent to meet all contracted effluent commitments, including those for Palo Verde. (JAE-LL, p. IV-2; Tables IV-1 and IV-2; McCain-Tr. 2310). In fact, the Update projects that there will be even more effluent from the 91st Avenue and 23rd Avenue Plants than previously scheduled. The 91st Avenue Plant is presently being expanded to 120 mgd and will be expanded again by another 30 mgd to bring it up to 150 mgd by 1985-1987. (JAE-LL, p. III-9; McCain-Tr. 2301; Hulse-Tr. 2301; Hulse-Tr. 542-544). The 1982 MAG 208 Update recommends that the 23rd Avenue Plant be expanded from 37.2 mgd to 42.5 mgd, and by the year 2020 it should be again upgraded to 48 mgd. (JAE-LL, p. III-13; McCain-Tr. 2308).

44. This MAG conclusion is also verified by the testimony of Robert McCain of the AMWUA. Mr. McCain refers to the proposed waste water treatment plants that may possibly be built in the future as satellite plants and subregional plants, the satellite plants being smaller plants with capacity of about 2 mgd designed for the reuse of effluent in an immediate area and the subregional plants being larger with two or more cities contributing to their flow. (McCain-Tr. 2427). Mr. McCain testified that the satellite plants would not have a large effect on the 91st Avenue plant and that the subregional plants would be primarily designed to take care of

anticipated future effluent needs rather than to take away existing effluent going to the 91st Avenue Plant. (McCain-Tr. 2427-2430). He also testified that it only makes good sense to have the 91st Avenue Plant operating at or near its capacity. (McCain-Tr. 2427).

45. In order to discredit the 1982 MAG Update, the Intervenor suggests that the recommendations and conclusions from that study may at some later date be revised. This Licensing Board acknowledges that projections for any study may be subject to future revisions, but until such time as such revisions take place based on the content and testimony with respect of that study, we must accept the study's results as being the most reliable estimates as to what will take place in the future. In this regard, there has been no suggestion by the Intervenor that the projections or conclusions in the May 1982 Update are in error.

46. Further assurance that satellite and subregional treatment plants will not divert effluent from Palo Verde is contained in a contractual provision in Agreement 13904 specifically providing that Cities are not allowed to install new plants that will impair their ability to deliver Palo Verde effluent (JAE-H, p. 17). Since Agreement 13904 is a contract which is presently in full force and effect (Hulse-Tr. 468), there would be no apparent reason why a court of law could not enjoin Cities from diverting effluent to

other plants if the Palo Verde effluent supply were to be jeopardized.

B. Possible Effluent Exchanges and Uses of Effluent for Municipal Purposes

According to the Intervenor, the Palo Verde effluent supply could be jeopardized if the Cities trade effluent for potable water. This could occur if there is a water shortage in the Phoenix area triggering a critical need under Section 21 of Agreement 13904. (Lorah-Tr. 1393, IE-XX, p. 4). Potential trading partners for such trades are Indian agriculture, non-Indian agriculture and industry (McCain-Tr. 2181-2183). In the event of a critical need under Section 21, it has further been alleged that the Cities could also use the effluent themselves for municipal purposes.

1. The Exchange of Effluent with Indian Agriculture.

47. There are three Indian Reservations in the State of Arizona that can be expected to use effluent as an exchange basis for potable water. Two of these reservations are in the Phoenix area and one is in the Tuscon area. (McCain-Tr. 2425). Any effluent going to the Tuscon reservation would come from the Tuscon area and not from Phoenix (Tr. 2425-26).

48. The most likely exchanges with Indian tribes will take place as part of the CAP program.(McCain-Tr. 2183). There is a strong incentive for the Cities to make exchanges with the Indians through the CAP mechanism since if they try to by-pass the CAP exchange pool and directly exchange effluent for first priority CAP water, the Cities will have their CAP allocations reduced by the amount of the exchange (McCain-Tr. 2190).

49. Under the preferred Department of Interior CAP option, 100,000 afy of municipal effluent will be exchanged for Indian CAP water by the year 2034. (McCain-Tr. 2183; JAE-Q, p. 15) The mechanism for this exchange is that after the year 2005 the Cities will be able to trade their effluent for an equal amount of CAP water. Exchanges before the year 2005 will result in a net loss for municipal supplies since the Cities would have to contribute 75,000 afy to 100,000 afy to the exchange pool and would only receive approximately 30,000 afy of CAP water in return. (McCain-Tr. 2185). Mr. Wesley Steiner believes that exchanges with the Indians will not take place until after the year 2010. (McCain-Tr. 2185). The CAP Environmental Impact Statement lists, as the worst possible case, that effluent exchanges may be necessary in the year 1992. (McCain-Tr. 2188-2190). Mr. Robert McCain believes the probability is that such exchanges will not take place until sometime during the years 2005 to 2010. (McCain-Tr. 2189-2190).

50. The proposed CAP exchange of 100,000 afy of effluent does not jeopardize the Palo Verde effluent requirements. This proposal, as set forth in the CAP Environmental Impact Statement, provides that such effluent exchanges are only required ". . . where feasible and consistent with contractual provisions." (JAE-Q, II-15). In addition, Mr. Steiner has specifically testified that the 100,000 afy exchange with the Indians proposed by CAP is to be made with effluent that is available after Palo Verde effluent requirements are met. (Steiner-Tr. 758).

51. Effluent exchanges with the Indians will not be practical in the foreseeable future because neither the 91st or the 23rd Avenue Plants are located near Indian reservations and it may be too costly to pipe the effluent that great a distance. In order to economically effectuate effluent exchanges with the Indians, regional treatment plants may have to be constructed. (McCain-Tr. 2191-2192).

52. The Cities presently do not intend for future effluent exchanges to adversely impact the amount of effluent going to the 91st and 23rd Avenue Plants since both of these plants are scheduled to be expanded in the future. (JAE-LL, pp. III-9, III-13; McCain-Tr. 2301, 2308; Hulse-Tr. 542-544).

53. For all of these reasons, the Board therefore concludes there is reasonable assurance that effluent exchanges by Cities to Indian

agriculture will not take place before the year 2005. In addition, we find that the 100,000 afy effluent exchange that is presently scheduled to take place through the CAP program is in addition to planned Palo Verde requirements and is not intended to interfere with this existing contractual commitment.

2. The Exchange of Effluent With Non-Indian Agriculture

54. Mr. McCain testified that effluent exchanges with non-Indian agriculture will take place during the years 1987 and 2002. (McCain-Tr. 2420). However, he was unable to adequately explain how this would occur. Although he identified possible exchanges that were presently being investigated between the City of Mesa and the Roosevelt Conservation District and between the City of Phoenix and the Roosevelt Irrigation District, the record reveals that both of those exchanges were speculative and that it is most doubtful that they would adversely affect the Palo Verde effluent supply. With respect to possible effluent exchanges with the Roosevelt Wat r Conservation District, it was developed during cross-examination of Mr. McCain that the District has never even participated in negotiations regarding this subject matter with the City of Mesa. In addition, it was also revealed that there can never be an effluent exchange between these parties until an effluent treatment plant is built in East Mesa (McCain-Tr. 2351-52). Effluent exchange for potable water between the Roosevelt Irrigation District (RID)

and the City of Phoenix appears to be equally unlikely. RID already has as option to buy 20,000 afy from the 23rd Avenue Plant which has never been exercised since 23rd Avenue effluent is not of suitable quality to meet RID's needs. Before RID would use this effluent for agricultural purposes it would probably first have to be injected into the ground where it could be filtered. (McCain-Tr. 2214, 2352-2354). Also dictating against RID ever acquiring effluent is the potential high cost of this injection process, the possibility that this process will not work, the possible adverse effects on RID's farming patterns, and the possibility that RID does not need the water (Id. at 2355-2358). There is also a possible legal barrier of transporting water out of a service area once it has become groundwater as a result of the effluent undergoing this injection process. (Id. at 2214, 2352-2354). For these reasons, this Board concludes that very little potential exists for effluent trades with non-Indian agriculture in the near term future.

3. Exchanges of Effluent With Industry

55. Witness McCain has identified industry as a source of possible effluent exchanges, but admits it would not take place before the year 2000 and would not amount to much (McCain-Tr. 2181, 2420). There was no evidence presented by the Intervenor that a significant amount of such exchanges are likely in the Phoenix area.

56. A limitation on the potential for this type of exchange would be that the industry making the exchange would have to be located near the effluent treatment plant before such exchanges could occur. (McCain-Tr. 2380).

4. The Use of Effluent for Municipal Purposes

57. Cities use of the effluent for their own municipal needs has not been identified as substantial enough to jeopardize the Palo Verde effluent supply. Witness McCain has identified parks, golf courses and greenbelts as potential areas where effluent might be used. (McCain-Tr. 2181) However, this type of use would be serviced by satellite treatment plants which would be located close to the source of the use. It is not believed that such satellite plants will adversely affect effluent supply to the 91st and 23rd Avenue treatment plants (McCain Tr. 2427-2430).

58. Another way the Cities could use the effluent themselves would be by recharging the treated effluent into the groundwater table and then withdrawing it in the future. But, as admitted by witness McCain, at this point in time such a process is not economically feasible. (McCain-Tr. 2182). Moreover, it is reasonable to assume that this process could not meet an emergency water shortage and thus it would probably not be utilized if a critical need arises under Section 21 of Agreement 13904.

59. One other type of municipal use that has been suggested for effluent would be if the Cities could treat the effluent to such a pure degree that it could be used for human consumption. (IE XXXIII, p. 12). However, Intervenor's witness Lemmon was not aware of any existing above-ground treatment plants that can perform this function (Lemmon-Tr. 1928-1931) and there is no evidence in the record that effluent plants that can perform this function are scheduled to be constructed in the future in the Phoenix area. (See JAE-LL).

60. Dictating against the use of effluent for human consumption is also the question of whether social acceptance would allow for such use. An example of adverse acceptance regarding effluent has already been encountered. The 1982 EIS for CAP specifically pointed out the main potential stumbling block to trading this effluent was social acceptance by the Indians before they would accept this effluent. (JAE-Q, pp. 71-72). It is important to note that the effluent use in that instance did not even involve human consumption.

61. For all of these reasons, the Board finds that there is reasonable assurance that the utilization of effluent by Cities for human consumption or as irrigation for parks, golf courses and greenbelts will not threaten the Palo Verde effluent supply in the forseeable future or, at least, during the first five years of Palo Verde operation.

C. Alleged Problems Regarding the Central Arizona Project Water Supply

1. Wesley Steiner's Conclusions Regarding CAP Water Availability

62. Two of Intervenor's witnesses, Mr. William Lorah and Mr. Robert McCain, testified that various adverse occurrences might jeopardize future CAP water allocations in the Phoenix area. These concerns regarding the adequacy of the CAP supply were not shared by Mr. Wesley Steiner, Director of the State of Arizona's Department of Water Resources. According to Mr. Steiner, the State of Arizona has concluded, based on very comprehensive studies, that under average supply conditions there will be at least 1.6 million acre feet of water available to the Central Arizona Project in 1985, declining gradually to 1.3 million in 2034. At least 800,000 acre feet will be available each and every year under the worst conditions of historic runoff. (Steiner-Tr. 751-752). Furthermore, because of reservoir storage, Mr. Steiner cannot conceive of there not being 1.6 million acre feet of water available for the CAP in 1985 through 1988 (Id. at 776-778) and he believes that the probability of having 1.6 million acre feet in each of the years from 1985 to 1990 is at least 90% (Id. at 796). Finally, Mr. Steiner's view was there is no chance that Arizona could fully utilize 1.6 million acre feet of CAP water in the years 1986 through 1988 (Id. at 778-780), and he specifically noted that in the year 1985 more water is allocated to

the Cities in the Phoenix area under the proposed action plan than they will subscribe to. (Steiner-Tr. 747-748, 750).

63. The Board accepts Mr. Steiner's conclusions concerning CAP water availability. First of all, his conclusions are based upon comprehensive studies made by the State of Arizona. Water availability figures from these studies were reached by tabulating the record of the Colorado River's flow from 1906 to date with the estimated level of development that would exist in the upper and lower basin states. Also involved were paper and computer studies of water supply and storage systems along the Colorado River. (Id. at 765-766, 796). Neither Mr. Lorah nor Mr. McCain, on the other hand, provided any studies of their own to show the manner and degree CAP water availability might be adversely affected (Lorah-Tr. 1495-1499). Furthermore, with the exception of certain figures pertaining to CAP water use in the Upper Basin States (Lorah-Tr. 1404), neither of these witnesses specifically addressed or challenged the reliability or adequacy of the CAP figures furnished by Mr. Steiner.

64. Secondly, the Board accepts Mr. Steiner's conclusion because of his extensive experience (26 years) with CAP and Colorado River water availability related matters. Much of this experience was with CAP programs that he was in charge of. Mr. Steiner's involvement in Colorado River matters began in 1956 when he was with the California Departament of Water Resources and was assigned the

duty of becoming that department's expert on Colorado River matters. In that capacity Mr. Steiner negotiated a compromise with the State of Arizona that enabled the CAP to be authorized by Congress. (Steiner -Tr. 740-741). He later became Chief of Water Resource Planning for the State of California (Id. at 738). On February 11, 1969 he began working for the State of Arizona as the State Water Engineer and Executive Director of the Arizona Interstate Steam Commission (Id. at 738). In 1971 when that Commission went out of existence, he became the Executive Director of the Arizona Water Commission. The Interstate Stream Commission was formed to protect and further Arizona's interests in interstate streams and international rivers and, in particular, the Colorado River. The Arizona Water Commission took over those duties and also assumed the statewide regulation of dams, water planning and the collection of hydrologic data (Id. at 739).

2. Specific Problems Raised by the Intervenor Regarding the Future Availability of CAP Water

65. In addition to accepting the conclusions of Mr. Steiner regarding CAP availability, we also specifically find that Intervenor's arguments regarding CAP availability either are not supported by the facts or do not provide a reasonable basis for assuming that there will be insufficient CAP water during the time frames encompassed within the Intervenor's contention. The potential adverse occurrences raised by the Intervenor were not

supported by any studies or calculations to determine whether the alleged occurrences would have a significant affect on the Phoenix water supply. In most instances, the Intervenor's witnesses did not even attempt to establish when such occurrences could take place and the amount of water that could potentially be lost. These conclusions, in short, were merely that there was a possibility that such events could happen and the Board accordingly finds that these arguments are speculative and conjectural.

a) The Special Master's Recommendation in the Arizona v. California Lawsuit

One of the uncertainties suggested by Intervenor witnesses Lorah and McCain was a recent Special Master's decision involved in the Arizona v. California lawsuit which awarded 120,000 afy of CAP water to certain Indian tribes. (McCain - Tr. 2209, Lorah - Tr. 1403). However, this information was not very helpful regarding the issues in this proceeding, because these witnesses failed to furnish such necessary facts as how much of the 120,000 afy would be subtracted from Phoenix's share of CAP water, and to what extent, if any, the loss of this CAP water supply would adversely effect water availability in the Phoenix area.

66. Furthermore, there is also a possibility that the Special Master's recommendation will not be upheld, inasmuch as Mr. McCain admitted that the Supreme Court may not accept the Special Master's recommendation (McCain-Tr. 2390). Although he claims that the

Supreme Court as a rule does not reject recommendations of Special Masters, this Board cannot give much weight to this statement since Mr. McCain is not a lawyer and he has never made a study of Special Masters Reports before the Supreme Court (Id. at 2424).

b) The Development of Upper Basin States to More Fully Utilize CAP Water

67. Witnesses Lorah and McCain also suggest that there might be greater development than presently anticipated in the upper basin states (New Mexico, Utah, Colorado, and Wyoming) which could fully utilize their CAP water allotment and thereby decrease the allotment for the Phoenix area. (McCain-Tr. 2376-2377; Lorah-Tr. 1408).

68. However, neither Messrs. Lorah or McCain attempt to quantiy the amount of CAP water which may eventually be lost to the upper basin nor do they predict the approximate dates when such water may be lost or demonstrate that such potential losses would significantly affect the Cities. Under these circumstances, there is insufficient basis to conclude that water supply in the Phoenix area would be jeopardized by greater development in the upper basin states.

69. In addition, the upper basin states may not diminish the flow to lower basin states to less than 75 million acre feet in any consecutive 10 year period. This will allow the upper basin a maximum of about 5.8 million afy, which would eleminate some of the losses

to the Phoenix area which Messrs. Lorah and McCain are suggesting could occur. (Steiner - Tr. 782-783).

c) Possible Draught Along the Colorado River

70. Another uncertainty suggested by Intervenor regarding the CAP water supply is that a series of dry years could adversely affect the amount of Colorado River water that would be available. (Lorah - Tr. 1403; McCain - Tr. 2209). These concerns have been answered by Mr. Steiner who testified that during the years 1985 through 1988 there will be an ample supply of water regardless of weather conditions. In this regard, according to Mr. Steiner, there will not be any problem through the year 1990 since Arizona will not be able to utilize its full share of Colorado River water until that time. (Steiner - Tr. 776-778).

Under these circumstances, this Board concludes that there is little likelihood that drought could adversely affect the Palo Verde effluent supply during the first five years of operation. Furthermore, in case of water shortages beyond that time frame on the Colorado River, the Cities would be one of the last recipients of CAP water to have their share reduced. During shortages, the first to be reduced are non-Indian agriculture and miscellaneous users. Next, 25% of the Gila River Indian Tribe and 10% of other Indian agricultural uses would be reduced. The last to be reduced would be the remaining Indian agricultural users and the city and industrial users. However, the city and industrial users would have

their pro rata share reduced no more than 510,000 acre feet. (Steiner-Tr. 754, 774-76, JAE-Q, p. 20).

d) The Low Priority of CAP for Colorado River Water

71. Witness McCain has also listed as an uncertainty the fact that the Central Arizona Project has the lowest priority of any other Colorado River water user and would thus be the first to have its supply reduced in times of shortage. (McCain - Tr. 2209). Mr. Steiner acknowledges that CAP has the lowest priority, but he explains that this was taken into account in the water supply studies. (Steiner - Tr. 780) He also pointed out that in the event of a shortage of CAP water, the potential exists to purchase some of the agricultural water along the Colorado River that is currently committed. (Steiner - Tr. 759).

e) Possible Delays in Building CAP

72. Witness McCain also testified that there is a low probability that there may be a delay in building CAP. (McCain - Tr. 2204), Contrary to this assertion, witness Steiner's testimony was most definite that construction will be completed in the Phoenix area by 1985. In this regard, 9 of the 12 reaches along the Phoenix aqueduct system have been completed. (Steiner - Tr. 743).

f) Political Matters Possibly Adversely Impacting Upon CAP

73. One other point made by witness McCain regarding CAP water is a recent report that the Peripheral Canal bill was defeated in California and that therefore exists a possibility that the California delegation in Congress will not support additional construction. (McCain - Tr. 2204-2207). The Board regards this type of political matter referred to by Mr. McCain as being entirely too speculative to be considered by this forum for a number of reasons, to include the fact that even if the California delegation in Congress does not support additional CAP expenditures, this is still no basis for concluding that this would cause a significant effect on the final outcome in Congress.

D. The Ground Water Management Act

74. The Intervenor has contended that Cities will not be able to drill new wells for groundwater as a result of the recently enacted Groundwater Management Act. According to Intervenor's witness, William Lorah, this new Act may prevent a City from receiving permission to drill a well in an area that it is not presently serving. (Lorah-Tr. 1399).

75. In 1980 the State of Arizona enacted into law the Groundwater Managemaent Act which establishes goals to control water development that have experienced extensive water-level decline in the past. The goal established for the Phoenix area is to bring into balance

groundwater withdrawals and natural recharge by the year 2005. (JAE-Q, I-6; McCain-Tr. 2169).

76. The Board finds that the evidence in the record fails to establish that the Groundwater Management Act will jeoprodize future water supply availability in the Phoenix area. Witness Steiner, the Executive Director of the Arizona Department of Water Resources, testified that the DWR has no authority to deny a permit to a city or private water company to drill a well as long as the drilling takes place within their service areas. Furthermore, Cities are allowed to expand their service areas over time. They can also expand by purchasing water companies and taking over their operating systems. (Steiner-Tr. 787-88).

77. Intervenor's witness Robert McCain's testimony also failed to establish any reasonable likelihood that the Water Management Act will cause water shortages. Although he believes there is some uncertainty about future well drilling, he also admitted there are no requests for service area well permits which have been denied, although a number are under advisement (McCain-Tr. 2212). Mr. McCain further testified that the Groundwater Code does not limit the amount of water that can be taken from existing wells and that the Cities still have the right to withdraw from any particular service area well that amount of groundwater necessary to supply its customers. (McCain-Tr. 2371).

E. The Renegotiations of Agreement 13904

78. The Intervenor also argues that the Palo Verde effluent supply may be adversely affected by possible future renegotiation of Agreement 13904. (IE-XX, p. 4).

79. The contract for Palo Verde effluent under Agreement 13904 is presently in full force and effect. Approximately 1.2 million dollars have already been made in option payments and delivery of effluent was begun on March 29, 1982. (Hulse-Tr. 468). There is no provision in this Agreement which permits termination earlier than its specified term (Hulse-Tr. 482).

80. Cities have attempted to renegotiate Agreement 13904. Their renegotiation requests concern their belief that the current contract price for effluent is not high enough. They also wish to supplement their water needs by being able to utilize amounts of effluent under the contract which is in excess of Palo Verde requirements (Hulse-Tr. 484-488). The renegotiation sessions between the parties have presently been terminated, but they may be resumed in the future (Hulse-Tr. 484).

81. This Board finds that there is no basis for concluding that the possible renegotiation of Agreement 13904 will jeopardize the Palo Verde effluent supply. Agreement 13904 presently provides for more effluent than is necessary to cool Palo Verde. If there are future

adjustments to the present contracted amounts of effluent, they would, presumably, only realistically take into account the amount of such excess. (Hulse-Tr. 485). Furthermore, since the Joint Applicants are under no legal compulsion to reopen negotiations (Hulse-Tr. 482) and there is no provision in Agreement 13904 which requires renegotiation, there will be no reason to jeopardize the Palo Verde effluent supply.

F. Lawsuits Involving Water Rights and the Question of Effluent Ownership

1. The PIMA-Maricopa Indian Lawsuit

82. Another argument advanced by the Intervenor to show that the Palo Verde effluent supply may be jeopardized concerns certain claims made in lawsuits regarding Indian water rights. The question presented in those lawsuits, as it applies to the Palo Verde units, is that the Cities may not have the legal right to sell this effluent to the Applicants since this effluent is subject to Indian claims and Bureau of Reclamation control. (Shaper-Tr. 839; McCain -Tr. 2216, 2230-2231; Lorah-Tr. 1437).

83. These legal questions of effluent ownership are presently being litigated as part of the Pima-Maricopa Indian community lawsuit against the Department of Interior in a Federal District Court. As fully discussed in the Opinion section of these findings, this Board finds that the Federal District Court is a proper forum for such

questions. In addition, in accordance with NRC precedent as also discussed in the Opinion Section, we shall not subordinate the NRC's licensing process to await the outcome of that lawsuit or attempt to factor in the possible rulings of that case whatever they may be, into our considerations of this case.

2. The Army Corps of Engineers' Proposal

84. Another attempt by the Intervenor to show that the Applicants are not legally entitled to wastewater effluent concerns an Army Corps of Engineer proposal involving effluent from the 91st Avenue and 23rd Avenue plants. The Intervenor has introduced into the record several letters between the Army Corps of Engineers and APS which indicates, among other things, that in 1977-78 the Corps might have been interested in a plan which would have allowed Buckeye to receive Palo Verde's effluent and in turn Palo Verde would have received Buckeye's groundwater. (IE-I-IV).

85. There is nothing in the record of this proceeding to suggest that the Corps of Engineers proposal was anything more than preliminary discussions, or that it was an official position of the Corps, or that the Corps had any authority to enforce it. In fact, the Applicants' response to this proposal was that if Corps of Engineers attempted to infringe upon Palo Verde's contractural rights, the Applicants' would oppose it. (Hulse-Tr. 516-520). Moreover, the discussions concerning the proposal in question took

place in 1977 anc there is no indication that these discussions were ever resumed.

G. Ground Water Contamination

1. The Contaminants TCE and DBCP

86. Intervenor's witness Mr. Edwin Swanson testified concerning various contaminants that have been found in wells in the Phoenix area. However, he was unable to predict to what extent well contamination will affect the future water supply in the Phoenix area since he has not computed the amount of future contamination there will be. (Swanson-Tr. 1863-1864).

87. Mr. Swanson specifically identified two problem contaminants, trichcloroethylene (TCE) and dibromochloropropane (DBCP), which have been found in some wells in the Phoenix area. (IE-XXX, pp. 3-9). Although he predicted that groundwater contamination may become a greater problem in the future (Id.at 12), no persuasive evidence was presented that TCE or DBCP can cause water shortages in the Phoenix area. Of the 202 City owned wells in the Phoenix area (McCain-Tr. 2350), only eight have been found to contain TCE above State action levels. (IE-XXX, p. 5). Wells which are contaminated by TCE can be used for various other purposes besides human consumption. (IE-XXX, Appendix A, p. 42). The use of TCE has been

greatly diminished because of the ad ent of air pollution control regulations. (Swanson-Tr. 1868).

88. Some wells containing DBCP have been located near citrus orchards in the Phoenix area. Of these wells, the State of Arizona Department of Health Services only recommended that three municipal wells be disconnected from the system. (IE-XXX, p. 8). DBCP contaminated water can be used for agricultural purposes. (Swanson-Tr. 1854). DBCP has been banned by EPA in a pesticide suspension hearing during the past two years. (Id., at 1867, IE-XXX, Appendix C, p. 2).

89. Although the TCE and DBCP contamination which has occurred in the Phoenix area may have somewhat reduced the flexibility of some Cities to deliver water, the Cities have been able to meet consumer needs. (Swanson-Tr. 1849-1851).

90. Problems concerning contaminated wells can be alleviated if the Cities take positive steps. Water contaminated by TCE and DBCP can be treated to make it suitable for human consumption by several techniques to include granular activated carbon and aeration. (Swanson-Tr. 1853, 1870-1871). Such treatment may be expensive, but it has been utilized in other parts of the country. (IE-XXX, Appendix A, p. 18). Moreover, if a well is contaminated, a City also can usually take corrective measures by drilling another nearby well into the aquifer to replace the well that was lost. This work

is a matter of technique which can be performed by knowledgeable individuals. (Swanson-Tr. 1857-1860, 1884). Additionally, if a portion of an aquifer becomes contaminated, steps can be taken to identify the magnitude of the plume so that future deterioration is minimized. (Id. at 1872, 1879)

91. For these reasons, this Board concludes that it has not been established that there will be a substantial number of contaminated wells or loss of groundwater in the future.

2. Improperly Operated Landfills

92. Intervenor's witness, James Lemmon, testified about groundwater contamination caused by improperly operated landfills. He specifically listed an 80 square mile area along the Salt and Verde Rivers that he believes is suffering from such contamination (IE-XXXIII, pp. 6-7) and he predicted that over a twenty year period approximately 700,000 to 800,000 acre feet of water in that area will not be available as drinking water without additicnal treatment. (IE-XXXIII, pp. 4-7; Lemmon-Tr. 1984-89).

93. Even though Mr. Lemmon has claimed that there is a potential loss of 700,000 to 800,000 acre feet of groundwater, the basis for this assumption is unclear since he was only aware of about three

operating wells within the affected 80 square mile area which supply drinking water to Phoenix residents and he could not even pinpoint the location of those wells. (Lemmon-Tr. 1919-1920). In addition, he was unable to estimate the average production from wells within the 80 square mile area. (Id.at 1921).

94. Mr. Lemmon's prediction of potential losses of 700,000 to 800,000 acre feet of groundwater is also negated by the fact that remedial measures can be taken to prevent this from happening. During his testimony, Mr. Lemmon admitted: (i) that technology currently exists which can treat contaminated groundwater to make it suitable for human consumption (Id. at 1922), (ii) that it is feasible to inhibit contamination of groundwater at existing landfills (Id. at 1964, 1957-1964. See also IE-XXXIII, Attachment B pp. viii, 1-6), and (iii) that existing EPA regulations are adequate to prevent landfill problems from occuring in the future (Lemmon-Tr. 1917). In specific reference to one of the landfills identified as contaminating water within the alleged affected 80 square mile area (the 40th Street Landfill), he testified that some corrective measures are currently being undertaken. (Lemmon-Tr. 1962, 1972; IE-XXXIII, Attachment B, pp. 1-6, viii).

III. Water Quality

95. The Intervenor makes two claims regarding water quality. One was advanced by her witness, William Lorah, who contended that the amount of effluent necessary for the Palo Verde units may be underestimated since, in his estimation, water quality in the Phoenix area in the future will deteriorate. The other water quality issue was advanced by her witness, William Robinson, who questioned the ability of Applicant's water treatment facility to perform as intended.

A. The Question of Whether Water Quality Deterioration in the Phoenix Area will Cause Palo Verde to use Greater Amounts of Effluent than Projected.

96. Intervenor's witness Lorah argued that the amount of effluent needed for Palo Verde is underestimated. According to Mr. Lorah, in order to prevent scaling and corrosion problems in the Palo Verde cooling system, the effluent being used must meet a sufficiently high degree of quality or additional amounts of effluent will be required. He further predicted water quality in the Phoenix area will worsen in the future. (Lorah-Tr. 1409-1419).

97. Mr. Lorah's testimony that water quality will worsen in the Phoenix area is not helpful in determining whether additional amounts of effluent for Palo Verde will be required since he has failed to quantify the extent of such alleged future deterioration. In this regard, he has not made any studies or written calculations concerning this subject matter (Lorah-Tr. 1495-1496) and he has failed to take into account that the extent of water quality

deterioration in the future may be somewhat minimized by the fact that higher quality CAP water is scheduled to take the place of lower quality ground water. (JAE-Q, I-6; Lorah-Tr.-1497).

98. Contradicting Mr. Lorah's contention concerning possible adverse affects caused by Colorado River water is the testimony of Mr. Wesley Steiner who testified that the addition of CAP water will not have any serious impact on the quality of water within the Salt River Project water boundaries (Steiner-Tr. 786). As this Board has previously noted, we give great weight to Mr. Steiner's expertise regarding CAP matters.

99. Even if Mr. Lorah knew the degree of water quality deterioration that will take place in the future, such a determination would be of little significance unless it could have also been established that the additional deterioration in Phoenix water or effluent quality could not be treated to acceptable levels. Yet Mr. Lorah did not take into account that Phoenix's waste water treatment plants, the Palo Verde on-site water reclamation facility and the Palo Verde circulating water system have the ability to accomplish this treatment. (Lorah-Tr. 1422-1423, 1516-1519, 1521, 1550-1551). In fact, Mr. Lorah's basic premise concerning the water reclamation facility and circulating water system was faulty since he assumed their treatment process will remain the same. (Id. at 1551-1552). On the contrary, however, the record establishes that acids, scale inhibitors, antifoam agents and chlorine will be

added as the need arises to treat higher concentrations of constituents. (Bingham-Tr. ff. 2585, p. 19). In addition, the water treatment facility can be modified if necessary to effectively deal with higher constituent levels to increase cycles of concentration. (Van Brunt-Tr. 2148).

B. The Question of Whether the Palo Verde Waste Water Treatment Facility can Adequately Treat Effluent so that the Palo Verde Units will not Require More Effluent than Projected

1. The Palo Verde Water Reclamation Facility and Circulating Water Systems

100. The effluent from the Phoenix and Tolleson Waste Water Treatment Plans will be further reprocessed at the Water Reclamation facility located at Palo Verde (Bingham - ff. Tr. 920, p. 2). Effluent treated at this facility is stored at the Palo Verde on-site reservoir which is used to supply the reactors' Cooling Water System. This reservoir contains a nominal 2300 acre feet of water that provides a minimum seven days of water supply for the three Palo Verde units under adverse demand. Make up effluent for the cooling water system is required due to evaporation and drift from the cooling towers and blowdown. (JAE X- pp. 3..3-1, 3.4.4).

101. The function of the cooling water system at Palo Verde is to remove heat from the main condenser. The transferred heat is then dissipated to the atmosphere from cooling towers. (JAE X-pp. 3.4-1 to 3.4-2). Chlorine, sulfuric acid, a foam control agent, and a

dispersant will be added to the cooling water system to control biological growth, reduce pH and control corrosion and scaling. (Id. at 3.4-4). Tubes made from titanium will be used as condenser tubes for resisting corrosion. Titanium is ranked as the best condenser tube material available. (Bingham-Tr. 2587-2588).

102. The circulating water system for Palo Verde can be impacted by the quality of wastewater effluent (the concentration of suspended and dissolved solids in the effluent) discharged from the 91st Avenue plant. The quality of effluent is important since it controlled the amount of scale formation, fouling, corrosion and biological growth, thus dictating the quantity of effluent required for blowdown to control these problems. (Bingham - ff. Tr. 920, pp. 2-3).

103. During the years 1973 and 1974 various tests were performed and a test demonstration plant and test circulating water system was constructed incorporating the features of the proposed Palo Verde systems. These tests determined that the principal constituents which can cause scale formation, fouling, corrosion and contribute to biological growths are calcium, magnesium, silica, phosphorous and ammonia (Id. at 3).

104. The treatment at the Palo Verde water reclamation facility to remove quantities of suspended and dissolved solids and to limit biological growth will consist of biological nitrofication, lime

treatment, filtration and chlorination. These processes are intended to purify the effluent to such a degree that concentrations of the effluent after it is injected into the circulating water system can be increased by a factor of 20 without excessive scaling, fouling or corrosion of system components and heat exchanges. (Id. at 4). For conservatism in estimating the quantity of effluent required for operation of the Palo Verde units, it is assumed that the blowdown requirements will only allow the concentrations in the dissolved solids to be increased by a factor of 15. (Id. at 5).

105. During the 1973-1974 testing period, to establish that 15 to 20 cycles of concentrations could be met and to deal with certain other problem areas, the Applicants performed certain specific tests for the circulating water system. One took place at the circulating water test facility at the 91st Avenue plant and simulated the Palo Verde circulating water system for tube flow velocity, temperature, and water chemistry. (Bingham-Id. at 35 ff. Tr. 2585, pp. 4-5, 7-9). The other test performed by Applicants was a laboratory test referred to as the "Bench Scale" tests. The Bench Scale tests confirmed the validity of the circulating water test facility tests in terms of water chemistry, controls of sludge formation, tube scaling and corrosion. (Id. at 14).

106. Both the cooling water test facility and the Bench Scale tests demonstrated that the Palo Verde cooling water system will operate at 20 cycles of concentration without excessive scaling, fouling or

corrosion. (Bingham - Tr. 2587). The adequacy of Applicant's tests were later confirmed by an independent review conducted by the Nalco Chemical Company which concluded that the Applicant's testing programs were adequate to represent the circulating water at 15 and 20 cycles of concentration and to evaluate corrosion and the use of chlorination. (Bingham - ff. Tr. 2585, pp. 14-15, JAE-DD). Based upon these three separate tests confirming that 20 cycles of concentration could be achieved, the Board concludes that there is reasonable assurance that the Palo Verde Circulating Water Facility will be able to meet this objective.

2. Criticism of the Tests for the Palo Verde Water Reclamation Facility and Circulating Water Systems

a) Sizing of the Circulating Water Test Facility

107. The circulating water test facility has a volume of 530 gallons, a desired flow rate of 154 gallons per minute, and a minimum flow rate of 100 gallons per minute; in comparison, Palo Verde's circulating water system will have a flow rate of 587,000 gallons per minute. The test facility thus is about one forty thousandth of the full size circulating water system (Robinson Tr. 1610).

108. Intervenor's witness, Robinson contended that the circulating water facility model was too undersized to be applicable to the

operations of the facility and thus the facility may not be able to perform as described (Robinson-Tr. 1615). He recommended that a larger scale model be constructed to verify performance of the full scale operational facility (Robinson-Tr. 1615, 1616, 1679)

109. Mr. Robinson's comments concerning the size of the circulating water test facility are misplaced. It was not the Applicant's intention that the facility be a scale model for the Palo Verde circulating water system. (Bingham - Tr. 2587). There was no need to construct a complete scale model since the design and operating criteria for Palo Verde circulating water systems was well established, being based upon the design, construction, and operation of hundreds of power plants of all sizes in the United States and elsewhere (Bingham - ff. Tr. 2585, pp. 2-3, 6-7; Robinson-Tr. 1747-1749). In fact, there has been some experience with operating facilities operating at 8-15 cycles of concentration (Staff Ex.-8, pp. 1-2; Bingham - ff. 2585 - p. 3) and there are nine power stations now operating with municipal wastewater as the condenser cooling water. (Staff Ex.-8, p. 2).

b) Geometry of Tubing and Condensers in Circulating Water Systems

110. Mr. Robinson also criticized Applicants' circulating water facility tests for failure to perform proper analysis for metals

which are to be used in the Palo Verde condensers. (Robinson, Tr. 1622).

111. The record indicates that Mr. Robinson's assertion regarding metal analysis is incorrect. In its circulating water facility tests the Applicants considered tube flow velocity, the temperature size of the circulating water in the condenser (heat exchanger), circulating water chemistry, and geometry in the context of scaling and corrosion. Tube flow velocities were used to determine whether metals in the condenser tubes would be harmed. (Bingham, ff. Tr. 2585, pp. 7-8). Also, tests were run with new titanium exchangers that were in configurations similar to that found in typical condensers. (Bingham-ff. Tr. 2585, p. 9; Robinson-Tr. 1725). In addition to these specific tests, Applicants took into account that corrosion in concentrated treated wastewater in the circulating water test facility was similar the to the corrosion that takes place in seawater. In this manner, the Applicants were able to establish proper metal usage from experience with seawater corrosion and were not limited to the corrosion experience established in their own tests (Bingham - ff. Tr. 2585, p. 9).

c) The Testing Duration of the Circulating Water Test Facility

Mr. Robinson also attacked the validity of the circulating

water tests because the testing duration for the test facility was only two weeks as compared to the eleven month operational period that the Palo Verde circulating water system will experience between maintenance shutdowns. (Robinson - Tr. 1629).

112. This criticism lacks merit because it overlooks the fact that there was ample operating experience at other power plants that Applicants were aware of to also establish the validity of the two week test period. (JAE-EE, Staff-Ex.-8; See also Finding 109).

d) Inconsistencies in Water Reclamation Plant Water Quality Data

Mr. Robinson also attempted to discredit Applicant's tests by pointing out several inconsistencies between data in Applicant's Water Reclamation Studies (JAE - BB) with data in the Palo Verde ER-OL (JAE-X). As set out in a chart prepared by Mr. Robinson, of the five chemicals of concern in determining water quality, only phosphate and ammonia were reported as having the same value in both reports. The calcium concentration was almost two and a half times higher in the water reclamation test facility than it was in the water reclamation plant estimate, and magnesium was 40% and silica 20% lower in the water reclamation test facility than they were in the water reclamation plant estimate. (Robinson-Tr. 1643; IE-XXVII).

113. This Board finds that the discrepancies noted by Mr. Robinson are not material since the circulating water system can handle higher than expected variations in constituent concentrations in the effluent from the water reclamation plant. A factor of two of inlet constituent concentrations to the circulating water system can be accommodated while still achieving the quality specifications for the water reclamation plant effluent being supplied as make-up. To offset larger amounts of particulate concentration, the circulating water system also has the capability for additions of acids, scale inhibitors, anti-foam agents and chlorine to achieve acceptable water quality (Bingham ff. Tr. 2585, pp. 18-19).

114. This Board further finds that the concentration variation for calcium noted by Mr. Robinson is not as great as he specifies. Apparently undetected by Mr. Robinson when he made his calculations, the calcium concentration is reported differently in the water reclamation facility study than it is in the ER-OL; in the ER-OL it is listed as a calcium ion Ca^{2+}, and in the water reclamation facility study it is listed as calcium carbonate $CaCO_3$. If the calcium concentration in the water reclamation facility study is converted to an ion Ca^{2+}, the concentration turns out to be 26.4 milligrams per liter (as Ca^{2+}) instead of 66 milligrams per liter (as $CaCO_3$). This results in the calcium concentration being only 6% higher in the ER-OL rather than 250% higher as stated by Mr. Robinson. (JAE-BB, Table 4-1; JAE-X, Table 3.6-1; IE-XXVII, WPR Table 1).

e) Cycles of Concentration

Mr. Robinson's charts (IE-XXVII, Table 2) show that insofar as concentration rates are concerned, only TDS (total dissolved solids), nitrate and flouride concentrated at exactly 15 cycles of concentration. The other harmful constituents, (calcium, silica, ammonia, magnesium and phosphate) concentrated at lower levels than 15 cycles with the exception of phosphate and magnesium which concentrated at higher levels. In regard to these differing levels of concentration, Mr. Robinson contended: (i) that the concentration rate is an important factor in evaluating the performance of the circulating water system, (ii) that the chemistry of the circulating water system is more complex that represented by Bingham's simple formula of blowdown/make-up = 15, and (iii) that further evaluation is required by the Applicant to determine how these different rates of concentration effect the circulating water system (Robinson-Tr. 1653, 1659).

115. Mr. Robinson's fears concerning differing cycles of concentration are unfounded. These cycles do not determine the limit at which the circulating water system can operate. The circulating water test was set up to simulate an actual circulating water system and not a hypothetical steady state system. Because this was not a steady state system, chemicals were added and as a result these concentrations were varied. The testing cannot be compared to the type of controlled experiment that a research

chemist would use to test a scientific hypothesis (Bingham-ff Tr. 2585, p. 16).

116. Another reason why the cycles of concentration varied was that sulfuric acid and chlorine were added to the circulating water test facility. When sulfuric acid was added to the test facility, Mr. Robinson admitted that this may have caused the sulfate concentration to increase beyond the factor of 15. (Robinson-Tr. 1729-1731). Mr. Robinson also admitted that the chloride concentration in the circulating water system would rise over time if there is a continuous flow to which chlorine is added. If there is a high chlorine demand, which is to be expected with waste water, the chlorine would react with other constituents, causing chlorine to continue to be added. Ultimately the chlorine will degrade to chloride, resulting in a much higher chloride concentration (e.g., greater than 15 cycles of concentration). (Robinson-Tr. 1742-1744).

f) Solubility of Certain Chemicals in the Circulating Water System Blowdown

117. Mr. Robinson also calculated in IE-XXVII that, based upon information obtained from several technical publications, solubility limitations for certain compounds will be exceeded in the Palo Verde circulating water system. From the technical publications in question, a limitation of 500,000 for the product of the

concentrations of calcium and sulfate and a limitation of 41,600 for the proejct of calcium and alkalinity was identified. (Robinson-Tr. 1667-70, IE-XXVII, 8.3)

118. The solubility limits set out by Mr. Robinson are refuted by the experience at other power plants which is equivalent to more than 100 plant years of operation. (Bingham-ff. Tr. 2585, pp. 16-17; JAE-EE, Staff Ex.-8). Joint Applicant Exhibit EE shows values for seven power plants which have calcium sulfate solubility values higher than the 500,000 or 5×10^5 solubility limitation given on page 25 in Intervenor's Exhibits XXVIII and XXVII, Table 3; the values in Joint Applicant Exhibit EE range from 2.9×10^6 to 48×10^6 (Bingham-ff. Tr. 2585, pp. 17-18) and Staff Exhibit No. 8 shows solubility values for power plants for calcium sulfate which range from 2.5×10^6 to 7.2×10^6. For the solubility values of calcium alkalinity, Joint Applicant Exhibit EE shows that there are plants operating substantially above the 41,600 limit given in Intervenor's Exhibit XXIX. For the seven plants listed in Joint Applicant Exhibit EE these values range from 97,500 to 300,000.

119. In Intervenor's Exhibit XXVII WPR Table 3, Mr. Robinson compares circulating water limitation criteria with values set out in Applicant's ER-OL and the Water Reclamation Facility Study. This comparison shows a sulfate concentration of 25,000 milligrams per liter and a calcium concentration of 800 milligrams per liter which results in a solubility value of 25,000 $[SO_4^{2+}]$ x 800 $[Ca^{2+}]$ =

2,000,000 (or 2×10^6)]. However, as admitted by Mr. Robinson, the calcium reported in the ER-OL is given as calcium carbonate (Robinson-Tr. 1732). If the calcium was given as the Ca^{2+}, then the concentration would be 320 milligrams per liter. This would result in a calcium sulfate solubility product of 25,000 $[SO_4^{2-}] \times 320 [Ca^{2+}] = 800,000$, which is much lower than 2×10^6. A corresponding change for the calcium carbonate solubility would result in a solubility value of 320 $[ca^{2+}]$ x 40 [alkalinity] = 12,800 instead of the 32,000 given in WPR Table 3. During his testimony Mr. Robinson also pointed out that an alkalinity of 1500 milligrams per liter as given in column 3, line 4 of WRP Table 3 (IE-XXIX) is not likely and that a concentration for alkalinity of 40 milligrams per liter is more likely (Robinson-Tr. 1734, 1735, 1738). However, if a concentration of 40 milligrams per liter is used for the alkalinity instead of the concentration of 1500 milligrams per liter, the calcium carbonate solubility will not be 630,000 as given in WPR Table 3 (which exceeds the limitation given by the Goldstein report) but will be 420 $[Ca^{2+}]$ x 30 [alkalinity] = 16,800 which is less than the limitation of 41,600.

120. The solubility comparisons provided by Mr. Robinson are also of little significance for a number of other reasons. He admitted that these limitations are only rules of thumb and cannot be considered hard and fast numbers (Robinson-Tr. 1696). He also admitted that an activity coefficient and ionic strength will affect the solubility

of the constituents (Tr. 1696-1698) and that Palo Verde waters would have a high ionic strength resulting in a very low activity coefficient. He also acknowledged that if the limitations that he gave in his Table WPR 3 are given and multiplied by an activity coefficient which is less than 1, his calculations for the chemical constituents given would be much lower than they are at present (Tr. 1700). Finally, Mr. Robinson agreed that if the solubility was higher than his suggested limitation this would only cause a potential for scale formation and he admitted that this problem could be alleviated by treatment for better water quality. He acknowledged that such water quality treatment is available by such methods as adding scale inhibitors to the circulating water. (Robinson-Tr. 1670-1671, 1681).

g) Water Reclamation Facility Reliability

121. Mr. Robinson also testified that Applicants' water reclamation facility studies revealed that the reliability for the water reclamation facility was extremely low. According to Mr. Robinson, these studies indicate that the chance for operation of the facility without a single mission failure was only 0.305 for twelve months and only 13.32 percent for three months. (Robinson-Tr. 1617-1618).

122. Mr. Robinson's concerns with the water reclamation facilities' reliability are unfounded since, as a practical matter, the apparent

poor reliability reported in the tests would not adversely impact upon the rest of the Palo Verde operations. No problems would be caused in other areas because repairs to the water reclamation facility could be done while using water from the storage reservoir. This explanation was reinforced by the testimony of Applicants' witness, Mr. Bingham, who stated that the Palo Verde electrical generators will continue to operate if there are system failures in the water reclamation plant. Mr. Bingham also stated that he has never heard of any down time to an electrical generator due to the failure of a water reclamation facility. (Bingham Tr. 2675).

123. Furthermore, the reliability of the Palo Verde Water Reclamation facility has greatly improved since the time of the study which Mr. Robinson bases his criticism upon. The design of the facility has been modified from a modular design to a parallel arrangement of active components with such improvements as redundant sludge pumps, spare pumps in the chemical feed system and automatic valves having by-pass connections. (Bingham-ff. Tr. 2585, pp. 19-20, Tr.-1295, 2681).

V. Damage to Effluent Treatment Plants by Industrial Waste Water

124. In addition to testifying about improperly operated landfills, Intervenor's witness Lemmon also claimed that industrial wastes

discharged to municipal sewage treatment systems may result in failure of the sewage system's digesters and biological treatment processes. His basis for this prediction is that a greater need for resource recovery in the future will force industries to discharge higher loads of acids and heavy metals into the sewage system. According to Mr. Lemmon, since heavy metals and acid waste are toxic to bacteria in biological sewage treatment processes, they may force shut-down of the biological treatment processes and digesters. (IE-XXX, p. 8).

125. This Board finds that Mr. Lemmon's fears concerning water contamination caused by industrial wastes are unfounded since, as he admits, biological treatment processes at the 23rd and 91st Avenue Plants will function as intended if the plants are operated properly and minimum EPA standards for industrial waste disposal are met. (Lemon-Tr. 1923-1924). There is no basis in the record for presuming that EPA standards will not be adhered to by Phoenix industry.

126. This Board also gives little weight to Mr. Lemmon's testimony because of his unfamiliarity with City of Phoenix pretreatment requirements for industrial wastes and his lack of knowledge concerning levels of acidity and toxicity which could cause failure of the biological treatment processes and digesters. (Lemmon-Tr. 1922-1923).

(VI) The Ultimate Heat Sink and the Fact That the Palo Verde Facility Can Be Safely Shut Down if There is an Insufficient Amount of Effluent.

127. The ultimate heat sink for each Palo Verde unit consists of two independent spray ponds which provide cooling water for the essential cooling water system during a normal shutdown or during accident conditions with no other water source available, (JAE-W, p. 9.2-63, Staff Exhibit-2, p. 9-14). The two spray ponds have sufficent water to provide cooling for at least 27 days following a design basis accident. (JAE W, p. 9.2-63).

128. The Intervenor has tried to raise as a safety issue in this proceeding the fact that the loss of effluent supply under Agreement 13904 could jeopardize the operation of the Palo Verde heat sink. The basis for this claim appears to be that in the past the Palo Verde reservoir (which will be supplied with effluent) has been identified as a possible backup source for the heat sink. (Staff Ex. 2, p. 9-14). The Staff presently accepts the Applicants' present position that the regional acquifier and not the reservoir is the backup source for the heat sink (Gonzales-Tr. 2482-2483, 2496).

129. Regulatory Guide 1.27 provides that a cooling capacity of less than 30 days may be acceptable if there is an alternate water supply to enable the heat sink to perform its safety functions. (IE, p. 1.27-4). The question of an alternate water supply for the ultimate heat sink is still an open item. In a memorandam of

May 10, 1982, the Staff stated that the Palo Verde 26-28 day water supply in the heat sink pond is acceptable provided that, among other things, APS identifies the sources of water that can be used after the spray pond is depleted. (IE-XXXV, p. 2). In a June 13, 1982 letter the Applicants responded that their backup source will be the 400 square mile regional aquifer. (IE-XXXV, p. 2). In the event of an emergency, water from the aquifer can be supplied from three existing Palo Verde wells. If these wells cannot be utilized within 27 days, a new well can be constructed that can deliver water to the ultimate heat sink within 15 days after the decision to build the well. (IE-XXXV, p. 3). The safe shut down earthquake is the proper accident scenario to review when considering the question of alternate water supplies since that accident encompasses all other events that might occur (Gonzales-Tr. 2470, 2487, 2489).

130. Staff witness Raymond Gonzales, who is the Staff reviewer for Palo Verde that will evaluate conformance with Regulatory Guide 1.27, believes the Applicants' June 17, 1982 alternative plan is acceptable and will recommend that it be accepted. (Gonzales-Tr. 2461, 2488). This Board agrees that the recommendations of Regulatory Guide 1.27 appear to be met.

131. Based upon the evidence of record, this Board concludes that there is no safety issue in this proceeding. Contention 5 is solely related to the effluent questions. The Palo Verde reactors are not dependent upon effluent for their safe shutdown.

132. As noted in § 9.2.5 of the SER, the Applicant has not yet provided sufficient information to alleviate Staff's concern on the lack of tornado missile protection for the essential spray pond nozzels. Until this information is provided, Staff cannot conclude that the ultimate heat sinks meet the requirements of General Design Criteria 2 and the guidelines set out in Regulatory Guides 1.27 and 1.117. (Staff Ex.-2).[4/] With the exception of information still necessary regarding the spray nozzels, this Board concludes that the evidence in this proceeding establishes that the Palo Verde heat sink can provide safe shutdown of the Palo Verde facility in the event that adequate effluent is not available for cooling purposes. By satisfying the recommendations of Regulatory Guide 1.27, the Palo Verde facility has an established capability for safe shutdown, to include the ability: (i) to permit simultaneous safe shutdown and cooldown of all nuclear related units that it serves, (ii) to maintain them in a safe shutdown position and; (iii) in the even of an accident to one unit, to permit simultaneous and safe shutdown of the remaining units. (I E - XII, pp. 1.27-1, 1.27-3). These capabilities for safe shutdown also establish that the question of effluent is not a safety issue.

4/ During the hearings Staff witnesses testified that the question of whether spray nozzels can withstand tornado missiles does not pertain to, and would not adversely affect, the Palo Verde water supply. (Licitra-Tr. 2476, Gonzales-Tr. 2477-2480).

CONCLUSIONS OF LAW

Based upon the foregoing Findings which are supported by reliable, probative, and substantial evidence as required by the Administrative Procedure Act and the Commission's Rules of Practice, and upon consideration of the entire evidentiary record in this proceeding, the Board makes the following Conclusions of Law:

1. The appropriate legal standard for this proceeding is whether there is a "reasonable assurance" that the Palo Verde Units 1, 2 and 3 will have sufficient effluent. The standard is not one which would require an assured source of effluent at all times.

2. Because the Intervenor failed to bring forward as contentions cost benefit balancing issues in a timely manner, and having failed to satisfy the late-filed contention arguments of 10 C.F.R. § 2.714, the Intervenor is not allowed to interject such issues in this proceeding.

3. Where environmental effects are remote and speculative, as they are in this case, there is no legal basis for denying an operating license for the Palo Verde project until all uncertainties are removed.

4. An environmental comparison is not necessary in this case since cost benefit balancing is only required if a proposed nuclear plant has environmental disadvantages in comparison to possible alternatives.

Because this is an operating license proceeding, cost balancing regarding alternative energy sources is no longer required under the Commission Rules amending Part 51. 47 Fed. Reg. 12940 (March 26, 1982).

5. The applicable requirements of 10 C.F.R. Parts 50 and 51 have been met as well as Section 102(2) of the National Environmental Policy Act.

6. This Board having considered and decided all matters in controversy among the parties related to operation, the Director of Nuclear Reactor Regulation is authorized to make such additional findings on uncontested issues as may be necessary to determine whether or not to issue a full-term operating license for the Palo Verde Nuclear Units 1, 2 and 3 and if so upon what conditions.

VII. Order

WHEREFORE, IT IS ORDERED that the Director, Office of Nuclear Reactor Regulation, is authorized upon making requisite findings with respect to matters not embraced in this Initial Decision in accordance with the Commission's regulation, to issue to Applicants an operating license for a term of not more than (40) years, authorizing operation of the Palo Verde Nuclear Units 1, 2 and 3; such license may be in such form

and content as is appropriate in light of such findings, provided that such license is consistent with the conclusions of the Board herein.

IT IS FURTHER ORDERED, in accordance with 10 C.F.R. §§ 2.760, 2.762, 2.764, 2.785, and 2.786, that this Initial Decision shall become effective and shall constitute, with respect to the matters covered herein, the final decision of the Commission 30 days after the date of issuance hereof, subject to any review pursuant to the above cited Rules of Practice.

Exceptions to this Initial Decision may be filed within ten (10) days after service of this Initial Decision. A brief in support of the exceptions shall be filed within thirty (30) days thereafter [forty (40) days in the case of the NRC Staff] any other party may file a brief in support of, or in opposition to, the exceptions.

IT IS SO ORDERED.

FOR THE ATOMIC SAFETY AND LICENSING BOARD

_____
Robert M. Lazo, Chairman
Administrative Judge

_____
Richard F. Cole
Administrative Judge

_____
Dixon Callihan
Administrative Judge

Dated at Bethesda, Maryland
this 23rd day of August, 1982.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
ARIZONA PUBLIC SERVICE COMPANY, ET AL.	)	Docket Nos. STN 50-528 STN 50-529 STN 50-530
	)	
(Palo Verde Nuclear Generating Station, Units 1, 2 and 3)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of NRC STAFF'S PROPOSED OPINION, FINDINGS OF FACT, CONCLUSIONS OF LAW, AND ORDER IN THE FORM OF AN INITIAL DECISION in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or, as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 23rd day of August, 1982.

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