

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

DOCKETED
USNRC

In the Matter of)
GEORGIA POWER CO., et al.)
(Vogtle Electric Generating Plant,)
Units 1 and 2))

Docket Nos. 50-424 and 50-425^{OL}

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AMENDED

INTERVENORS' RESPONSE TO APPLICANTS' MOTION FOR SUMMARY DISPOSITION OF CONTENTION 7

Joint Intervenors hereby file their amended response to Applicants' Motion for Summary Disposition of Joint Intervenors' Contention 7 (Groundwater).

The Board, in its order dated 5 September 1984, admitted Intervenors' Contention 7, which reads:

Applicant has not adequately addressed the value of the groundwater below the plant site and fails to provide adequate assurance that the groundwater will not be contaminated as required by 10 CFR 51.20(a), (b) and (c), 10 CFR 50.34(a)(a) and 10 CFR 100.10(c)(3).

The Board agreed with Intervenors that new information concerning contamination of the Tuscaloosa Aquifer beneath the Savannah River Plant site raises new questions concerning the validity of Applicants' assurances that the geology of the Plant Vogtle site prevents any danger to the groundwater.

William F. Lawless, formerly senior project engineer at Savannah River Plant and now at Paine College, provided much useful information to the Board and is serving as Intervenors' expert witness on groundwater. Professor Lawless has analyzed Applicants' Motion for Summary Disposition of Joint Intervenors' Contention 7, an analysis which follows this introduction and is incorporated as part of this response. Professor Lawless was out of town as his statement was transcribed; in order to file it in a timely manner, Intervenors provided it to the Board and other parties before Professor Lawless's return, but requested permission to file corrections if necessary; this amended filing includes Professor Lawless' corrections.

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Analysis of Affidavits by Bechtel Geologists and Engineers
and Applicants's Statement of Material Facts

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August 8, 1985

General Comments

1. The affidavits and supporting facts were provided by contractors (Bechtel geologists and engineers); fees for these documents were not but should be provided. As well, the estimated VEGP groundwater management plan costs (fixed and variable) should be provided.
2. The 1971 groundwater chemical analysis should be updated. It has been found that Sr-90 contamination in the VEGP (Vogtle Electric Generating Plant) area, likely due to SRP releases, is significant (cf FES). There is the possibility that other released chemicals may have changed the 1971 datum.
3. Scientific inference has not been used with the groundwater data collected at VEGP. The lack of a statistical treatment of the data may obscure serious flaws in conclusions concerning groundwater under VEGP.
4. Applicants have come to depend on the impermeability of the marl underlying VEGP to protect the Tuscaloosa Aquifer. The sinking of the VEGP facility, sitting directly atop the marl, represents plastic deformation or fracture of the marl, and may defeat the marl as well by differential downward flow rates of the grouted wells underlying the facility. Bechtel geologists failed to address this issue.
5. There appear to be numerous flaws in the affidavits provided by Bechtel geologists and engineers.

Affidavit of Jagannathan, et al Comments

1. Long term operational processes contribute to radionuclide and hazardous chemical migration not only through the accidental equipment failure pathway but also through continuous, minor but neglected leaks that accumulate and eventually become significant in total impact.
2. The affidavit provides no research or experiential reference frame to allow a credible judgement of assertions. Construction must be completed in accordance with NRC regulatory guides which set the standards for construction; however, without

Georgia Power/VEGP performance (where available) in similar circumstances, without contractor (Bechtel) performance, and without industry performance, system by system assertions that standards or criteria have been met by Bechtel are meaningless. Comparisons with actual operating experience by the Applicants, the construction contractor (Bechtel) and the industry and regulators (from NRC) should be provided in order to make competent assessments. For example, "Tanks and related piping containing radioactive liquids at Plant Vogtle are designed and constructed to stringent standards" (p. 3, para. 4) in itself is only an assertion. The past failure rate, leak rate, etc. with similar systems should be provided. Applicants are free to make or collect any assertion, however, experience has shown that assertions are inadequate in preventing radionuclide and hazardous chemical migration.

3. Company and industry experience with RHT/WECHT containment, and refueling water and reactor makeup water tanks should be provided, otherwise affidavit assertions are not testable.

4. The assertion that wall fracture of the auxiliary building wall will result first in a groundwater influx is speculative and opinionated and not supported by research or experience, e.g., if the crack is at the bottom and air pressure maintained, no influx may result.

Applicants' Statement of Material Facts Concerning Groundwater

There is much issue to be heard with respect to Applicants' statement of facts. Many of the issues are confounded by conflicting and insufficient data and tests. Hazardous waste migration has been ignored by Applicants. The deformation and consequence of VEGP settling on the marl has been overlooked. The marl groundwater well patterns have not been discussed. In short, the statement of facts by Applicants are the presentment of a legal disputation, not a technical analysis of the possibility or consequences of groundwater contamination. Comments follow the

presentation of supposed facts by Applicants.

p 1. Applicants have not extensively explored the geology and hydrology of Plant Vogtle.

p 2-3. Applicants admit the geology and hydrology under the blue marl is uncertain.

p 4-6. The assertions that the marl underlying VEGP is 70 feet thick, confines the Tertiary/Cretaceous aquifer system, and is impermeable is based on an admitted non-statistical treatment of VEGP exploration and observation data. This data is primarily from 22 exploration holes and amounts to inadequate conclusions from inadequate data. Three of these holes drew water and three others were discounted by Applicants, thereby increasing the uncertainty of the explorative data; yet a statistical error analysis has not been performed.

p 7. Applicants assert the marl is continuous but only provide proof that the marl has not been found to be discontinuous, primarily based on data from one research well series, well 42. This is analogous to fishing in only one spot on a large lake and generalizing on fish, water levels, and conditions in the rest of the lake. A large uncertainty exists in Applicants' data that may be resolved with a statistical treatment.

p 8-9. Applicants' state VEGP is on an interfluvial underlain by the blue marl. This statement is flawed because of its unbounded certainty. The VEGP data do not support this level of certainty, especially since Applicants have admitted they have not statistically treated their data. (See further Applicants' First Supplemental Response to Intervenor's Third Set of Interrogatories and Requests for Production of Documents," 5 July 1985.) The Savannah River Plant (SRP) made similar assertions in the past that have since proved to be in error.

p 10-13. Applicants assert that a significant spill of radioactive liquid at VEGP is extremely unlikely, yet no experiential frame of reference has been attested by Applicants. This then is not a statement of scientific fact but an opinion in good

conscience, but as such, has little value in this document. This style of presentation is similar to an advertisement and continues. For example, alarms (without specification or operating history) are included in outside radioactive tank systems, but at SRP, it is not uncommon for alarms to malfunction, yet the statement that the alarm is available is meant to resolve any concerns about leaks that might arise; however, knowledge of the many problems associated with alarms leads to greater concern, not less.

Applicants address only radioactive waste releases and have left out all reference to hazardous chemical releases.

p 14, 17. Applicants assert, based on their construct of the geohydrology of VEGP, that releases would not breach the marl. It has been observed many times in the past that rhetoric (see especially the SRP EIS written in 1977, ERDA 1537) is not an efficacious barrier to the migration of radioactive or hazardous wastes.

p 15 The SRP experience is invaluable and readily applies to VEGP especially when comparing the type of all-inclusive statements made by SRP in the past with those by VEGP today. Applicants assert that the contamination at SRP stemmed from the use of waste seepage basins whereas the largest concentrations of contamination at SRP entering the M-area groundwater resulted not from the M-area seepage basin but from long-term leaks out of a waste holding tank. In 1977, SRP asserted (ERDA 1537) that the marl and other, much deeper clay barriers were present and would prevent downward migration of radionuclides and hazardous chemicals. The impermeable barriers under M-area have since been found not to be present. Applicants have made blanket statements similar to those made by SRP, statements SRP changed only after contamination was found in drinking water pumped from the Tuscaloosa Aquifer.

p 16 Applicants agree on the one hand that a well casing (SRP) may have become a pathway to radionuclide migration but then assert the well may have been improperly grouted whereas VEGP uses the Tremie method which assures grout-seal integrity. This is an advertisement and not a scientific or engineering statement of

specification in an operating history frame of reference.

p 18 Applicants assert that contaminated groundwater would move towards Mathes Pond. Applicants' data do not agree with this statement and it may be in error.

p 19 Applicants assert the groundwater travel time to Mathes Pond is 350 years using methods since found to result in large margins of error by experts in the nuclear waste management industry. Using similar methods, the NRC calculates the worst case shortest travel time at 15 years. The SRP found contamination traveled about 4 or more times faster than had been calculated with similar but more conservative methods than used by VEGP. Thus the worst case travel time could be less than 5 years, not 15, and between 20-30 years for normal travel time, not 350 years.

p 20 Based on calculations, assertions, and assumptions, any conclusion is possible, not necessarily valid.

Affidavit of Crosby, Farrel, West (VEGP geologists)

It is of note that these geologists appear to be well-qualified field geologists. However, many of the geology-hydrology contaminant interactions do not lend themselves to an ease of understanding, rather most of the interactions or effects are abstruse. The first hallmark of this affidavit is the strong certainty with which the facts and understandings are presented, and the second is that this presentment is made by geologists with extensive field experience and apparently little or no research experience, that these geologists work for the prime contractor Bechtel and are not independent contractors, and that these geologists do not have advanced degrees in geology. Much of what is known today in hydrogeology interactions with contaminants has been recently learned, casts doubt over many theories and ideas from the last decade, and foreshadows how much is yet to be learned or yet discarded. The first comment is general (para 1-13): Applicants should explain why more qualified geologists have not been used. Does this mean

that research scientists (with Ph.Ds) are not capable of understanding, assessing, and supporting the Applicants' contentions that the Tuscaloosa Aquifer would be protected by the VEGP underlying marl, or does this mean that such scientists would be able to correctly assess these impacts and therefore have not been used?

Specific comments follow the Crosby et al. affidavit:

p. 14-18 Geologists attest to extensive exploration and well canvassing, but not to the closure of exploration holes. Most of the exploration and observation analyses were done in 1971, especially the water chemical analysis datum. This datum has not been updated. No closure information is provided on coring of the marl. The geologists state there are 24 monitoring wells into Tertiary Aquifer whereas Applicants' statement of facts list 22 exploration wells. Are the monitoring wells in addition to the exploration wells?

p. 19-20 a. Over 200 wells/holes have been used to establish the marl data base (cf Figure 3). Geologists aver this to be a reliable data base but did not explain the well-pattern. b. About 67 punctures are into the marl close by and under Units 1 & 2, mostly exploration holes but also observation wells and a make-up well, with about 40 holes directly under Units 1 & 2. c. The well mapping pattern is a lazy reverse L from the river to and through Units 1 and 2, and appears to cover much less than 20% of the areal extent of the VEGP site, mostly centralized around the facility itself, more than likely not for hydro-geologic mapping in selection/preparation against radionuclide and hazardous chemical spills, but apparently mapping for plant construction data. This suggests that at the times these wells/holes were created, the Eachtel geologists were not concerned about groundwater contamination/migration nor groundwater management, but constructing VEGP. The pattern further suggests that VEGP groundwater management may not provide reliable data, and may now be more for appearance than actual benefit. d. The marl permeability mapping repeats the reverse L pattern with concentrations near the

Savannah River hardened area, under Units 1 & 2, and around Mathes Pond to the northwest. e. There is no marl mapping south of Units 1 & 2, especially towards nor around Telfair Pond.

p 21-24 General geologic assertions by geologists. No discussion on deformation of marl due to plant settling, nor sinking rate, nor impacts.

p 25 Compare the following statements:

"In the very unlikely event that an accidental spill of radioactive fluid occurred at Plant Vogtle and infiltrated the ground without interception, it could percolate downward until it reached the water table (unconfined) aquifer. The underlying Blue Bluff marl, however, would prevent further vertical movement of contaminant from reaching the deeper Tertiary/Cretaceous (confined) aquifers. Any further migration would be lateral and in the direction of...Mathes Pond..." (affidavit Crosby et al, p 11-12)

"Any contamination entering the ground water from H area would be transported both downward and laterally, especially laterally at each clay barrier. Because water heads in the Tuscaloosa are higher than in the Congaree, such contamination would be discharged into [a nearby surface stream] before it could enter the Tuscaloosa." (SRP report ERDA 1537, p 11-154, 1977).

"The large Tuscaloosa aquifer is 300 feet deeper than the near-surface groundwater, separated by several nearly impermeable clay barriers, and is at a higher artesian pressure than the groundwater. Thus, flow of contaminated groundwater could not reach the Tuscaloosa aquifer. Radionuclides that enter the near-surface groundwater would decay to permissible levels before reaching the nearest creek because of low groundwater velocity and ion exchange characteristics of the soil." (Letter from the Dupont Director of the Savannah River Laboratory to the manager of the Savannah River Plant, 29 September 1976)

In the last two statements, made by SRP, are assertions of what could and could not happened in the groundwater/Tuscaloosa Aquifer under SRP; the conclusions based on these assertions have since been proved wrong.

p 26. The geologists do not give actual marl permeability by specific location but instead categorize the marl as a type and report permeabilities for this type. This is not acceptable. Further, the geologists generalize this type permeability to the marl supposedly underlying the entire VEGP site. This is also unacceptable.

p 27-30 Only twenty-two exploration holes were made into the marl, six with measureable water intake. However, the Bechtel geologists nonetheless have not performed any uncertainty analyses, nor bounded these data with error bounds, nor

used statistical analyses on the marl data (see "Applicants' First Supplemental Response to Intervenor's Third Set of Interrogatories and Requests for Production of Documents," 5 July 1985). Both limited testing by apparently less qualified groundwater specialists, albeit possibly well-qualified construction geologists, and a failure rate of more than 25% of the exploration holes increases the possibility of confounded conclusions, especially that there are no voids, no solution cavities, few fractures or zones or open joints within the marl. Bechtel geologists attest that 10,000 feet or more of the marl has been penetrated, each foot representing a potential pathway for radionuclide and hazardous chemical contamination and migration. Bechtel geologists make no statements on the impact of the integrity of the marl from the deformation of the marl by the weight of VEGP.

p 31 The higher head in the unconfined aquifer over the lower confined aquifer implies that openings between the two aquifers will likely result in a downward contamination flow path exacerbated by the gravitational potential of contaminants.

Figure 9 is a groundwater contour map suggesting flow directions. Using Bechtel geologists' data, the flow in the unconfined aquifer is clearly to the northwest, southeast and southwest under VEGP, quite at odds with conclusions by Bechtel geologists. Figure 10 is Bechtel geologists confined water contour map suggesting flow directions northeast towards the river from under VEGP, however Chapter F (SRP L Reactor EIS, Volume 2) suggests that Tuscaloosa water movement is towards the river and northwest as well, paralleling the river from under VEGP. (See also Figures 13 and 14.) These geologists admit the possibility of "...through-going openings..." (p 15) in the marl, but aver that the number would not be significant, contravening or confounding the earlier conclusion..."that there are no voids or solution cavities in the marl and that there are not systematic or extensive fractures or joint sets in the marl." (p 14)

p 32-34. The only quantifiable through-the-marl head differential data into any location apparently comes from well series 42 data dated year 1971. The data itself

appears to be confounded because of measurable water flow within the impermeable marl (wells 42 B and C). On the one hand, the Bechtel geologists state that head differentials measure the energy potential of the water in an aquifer, but inside of the impermeable marl, the geologists state that water level readings in the marl do not indicate marl permeability, but rather do indicate the hydrostatic pore pressure inside the marl due to changes in atmospheric pressure. Apparently, somehow, the geologists feel that the marl is impervious to water but is open to air. No data is offered to support this conjecture.

p 35 Conclusion by Bechtel geologists that unconfined flow beneath the power block area is northward (actually northwestward) to Mathes Pond is contradicted by their referenced Figure 9. Movement is just as likely westward, southward and southeasterward, especially considering surface topology, Figure 6.

p. 36-38. The assertions by geologists of the low possibility of well or aquifer contamination in the area is hopeful but an unlikely preventative in itself. Assertions may be effective after comparison to company, regional industry, Bechtel contractor, and nuclear industry operating experiences on groundwater contamination. The most artful or scientific expostulations that groundwater contamination will not occur has seemed in the past inefficacious. A better approach is to compare to experiential references, and to independent peer review all groundwater management documents and programs.

The water tables are described fortuitously as isolated. Recharge is not shown nor are water divides. Unconfined flow is described by Bectel geologists as always to Mathes Pond and not from ponds/lakes downward. This is a simplistic, fortuitous model.

p 39-40 Bechtel geologists considered accidental releases from the RHT and WECHT by using what they considered to be extreme assumptions for radionuclide releases. The geologists did not consider long term leaks, did not consider hazardous chemical

migration, and did not offer an experiential reference frame composed of past Bechtel design facility experience with groundwater contamination, nor regional nor industry nor Georgia Power company experience.

p 41-43 Extrapolating from experience at SRP where similar calculational techniques bore a groundwater travel time estimate a minimum 4 times slower than was actually validated for SRP groundwater travel time, the VEGP groundwater travel time to the nearest stream can be recalculated to be 15-20 years to the tributary extending north out of Beaverdam Creek; an estimate to Mathes is about 20-30 years (using a differential velocity gradient estimate). Using a core-melt liquid-pathway route, the worst case shortest time for nuclides to the closest stream appears to be less than 5 years, and Mathes Pond at about 5 years.

p 44. Darcy's Law presupposes that groundwater velocity can be modelled through the determination of one dimensional temporal or spatial invariants, parameters or coefficients, gradients and porosity. Bechtel geologists have not proved the applicability of nor validated Darcy's Law for extended distances through the VEGP groundwater aquifer. Bechtel geologists should present the groundwater and contaminant continuity equation and discuss boundary conditions. Bechtel geologists should discuss the applicability of numerical methods to construct a groundwater VEGP model algorithm, and also discuss why computer simulation has not been used for groundwater and contaminant migration. Using Darcy's groundwater flow equation, SRP made similar estimates in calculating groundwater travel time at SRP for subsequent dose consequences (Appendix G, ERDA 1537, especially Figure G-3; also, DPST-83-839, Vol. 1, p. 3-24). Although the SRP model was apparently more sophisticated than that used by Bechtel geologists, the SRP model nonetheless significantly underestimated groundwater travel time and contaminant transport velocities (DP 1638; The Savannah River Plant: Hazardous and Radioactive, W.F. Lawless, submitted to SRP for publication).

p 45 Using Darcy's Law, Bechtel geologists calculate a fixed groundwater velocity

of 36.2 ft/yr. SRP calculated 32 ft/yr through a sand lens with a hydraulic conductivity of 7.4 gpd/ft² (DPST-83-829, Vol. 1, p. 3-24) but noted tracer tests for the same location yielded the much higher velocity of 180 fpy (DP 1638) in some areas of SRP. Comparing the prediction of 32 ft/yr to the actual ranges of 2.3 to 180 ft/yr is the reason why an uncertainty analysis is important in analyzing groundwater/contaminant migration data.

p 46 Bechtel geologists considered only radionuclides, not hazardous chemicals, nor synergistic effects or interactions of the two, nor increased flow rates due to increased head from a liquid discharge point (e.g. liquid effluent discharge system).

p 47 Strontium-90 travel time in groundwater transport at SRP has been found to be much quicker than anticipated, significantly quicker than the strontium-90 rates of decay, dispersion or adsorption (DPST-83-829; The Savannah River Plant: Hazardous and Radioactive).

p 48-49 Invariant coefficients used by Bechtel geologists will result in calculations that usually cannot be validated in the field over extended distances. Groundwater contaminant transport is a stochastic process not effectively modeled by time-invariant equations. SRP has found that K_d coefficients vary considerably for each nuclide species, nuclide valence, associated chemical matrix, and numerous other factors. The deterministic approach used by the Bechtel geologists is a simplistic approach that avoids statistical treatment of the stochastic processes of groundwater contaminant transport and interaction.

p 50 The TF calculations for H-3 can be approximated using provided data, but cannot be replicated. Bechtel geologists should provide a sample calculation with units.

p 51 A sample ARF calculation should also be provided by Bechtel geologists, with units. Geologists should also justify the K_d values used and why they are

invariant. In one comparison (DOE/EIS-0108, p. F-84), SRP found that the diminution of Sr-90 concentration with distance from source (about 1500-2000 ft.) was almost negligible. This compares sharply with results of 4 orders of magnitude decrease in initial versus final concentration after traveling 500 feet through the VEGP backfill (undefined porosity).

p 52-56 Geologists assert their calculations to be conservative whereas this analysis of the Bechtel geologists affidavit concludes that, as were many SRP assertions, the Bechtel geologists' assertions are unvalidated by field experience.

p 57-59 Bechtel geologists attest that communication between the confined/Tuscaloosa aquifers is open to the Savannah River, but that communication is one way. Data from SRP and VEGP sources suggests that the Tuscaloosa pressure surface is higher than the river, indicating preferential flow from the aquifer into the river. It is simplistic and likely erroneous to presume all aquifer water flows directly to the river from under VEGP. Bechtel's geologists suggest as much themselves by Figure 2 and Figures 13 and 14. Further, contaminant communication from the lower Tuscaloosa into the river, or the reverse, depends on many factors, not only pressure gradients but differential concentration and gravitational gradients plus other physiochemical and hydrogeological factors.

Bechtel geologists suggest that flow reversals are not possible until aquifer withdrawal rates exceed rejected recharge rates. Nonetheless, reversal can easily be obtained in the well-head local region with fairly typical industrial withdrawal rates and is being demonstrated in the I/R cleanup campaign in M-Area.

p 60-61 Contamination has been found in 4 production A/M area Tuscaloosa wells and at least 3 other Tuscaloosa observation wells. The contaminating organics came not only from a waste seepage basin (clogged since the late 1970s), but under leaking pipes and a solvent storage tank. The highest concentrations of organics and deepest downward penetrations to the bottom of the Tertiary are under the solvent storage tank.

Bechtel geologists aver that SRP geology in A-Area does not preclude percolation of contaminants down to the Tuscaloosa, whereas VEGP geology prevents this. However, SRP made similar assertions beforehand in 1976 and 1977 (cf p 25). p 62-66 Bechtel geologists assert that the green clay/marl in H-Area at SRP is an effective barrier to groundwater movement into the Tertiary aquifer in H-Area at SRP. However, this assertion is speculative and cannot at present be proved or contradicted because of the paucity of Tuscaloosa well readings in that area. p 67 SRP has speculated that the primary pathway for Tuscaloosa contamination has been through well casings, not vertically through the intervening aquifers. However, other SRP data suggests even if so, contamination downward through intervening aquifers should occur shortly. p 68-72 Wells penetrating the marl should be considered the primary pathway for radionuclide and chemical contamination at VEGP. The tremie method should be detailed and validation experience provided.

[This concludes Professor Lawless' presentation, with corrections.]

Conclusion

In conclusion, Applicants have clearly failed to prove that Intervenor's Contention 7 (groundwater) should be dismissed and their Motion for Summary Disposition should be denied.

Respectfully submitted this, the 21st day of August, 1985,

Tim Johnson
for Intervenor
Campaign for a Prosperous Georgia and
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