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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Thomas S. Moore, Chairman
Dr. Charles N. Kelber
Dr. Peter S. Lam

In the Matter of DUKE COGEMA STONE & WEBSTER (Savannah River Mixed Oxide Fuel Fabrication Facility)	Docket No. 070-03098-ML ASLBP No. 01-790-01-ML February 2, 2005

MEMORANDUM AND ORDER
(Granting Applicant's Motion for Summary Disposition on Contention 3)

I. Introduction

We have before us the motion of the Applicant, Duke Cogema Stone & Webster (DCS), filed pursuant to 10 C.F.R. §§ 2.749 and 2.1237,[1] for summary disposition of contention 3.[2] That contention, as admitted, challenges the seismic analysis presented by DCS in the Construction Authorization Request (CAR)[3] submitted for the Mixed Oxide Fuel Fabrication

[1] 10 C.F.R. Part 2 was amended on January 14, 2004, but the amended provisions are applicable only to proceedings noticed on or before February 13, 2004. The instant proceeding is governed by the former 10 C.F.R. Part 2, Subpart L (i.e., informal hearing procedures). The Commission directed, however, that the Intervenors must file contentions and that the parties were entitled to use limited interrogatory and disposition discovery. See CLI-01-13, 53 NRC 478, 480-82 (2001).

[2] See Duke Cogema Stone & Webster's Motion for Summary Disposition on Contention 3 (Aug. 22, 2003) [hereinafter DCS Motion].

[3] See Duke Cogema Stone & Webster Mixed Oxide Fuel Fabrication Facility Construction Authorization Request (Feb. 28, 2001) (revised Oct. 31, 2002).

Facility (MOX Facility).[4] The Intervenor, Georgians Against Nuclear Energy (GANE), opposes the motion, arguing that summary disposition is not appropriate because the contention contains several genuine and material disputed factual issues.[5] For the reasons set forth below, we grant the motion for summary disposition of contention 3.

II. Background

This proceeding involves DCS's application to build a MOX Facility on a 41-acre site lying in Aiken County, South Carolina within the Department of Energy's (DOE) 310-square-mile Savannah River Site. DCS submitted the original CAR to the NRC on February 28, 2001.[6] In response, GANE filed, inter alia, contention 3 challenging the seismic design of the MOX Facility, discussed in Sections 1.3.5 through 1.3.7 of the original CAR.[7] The Board admitted contention 3 in its December 6, 2001 Memorandum and Order.[8] The gist of contention 3 asserts that DCS has not performed a seismic analysis that is either adequate in scope or documentation.[9] In support of its contention, GANE challenges the CAR's discussion of both the likelihood of a significant earthquake and the response of the MOX Facility site to an

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[4] See LBP-01-35, 54 NRC 403, 429-32 (2001) [hereinafter Memorandum and Order on Contentions].

[5] See Georgians Against Nuclear Energy's Opposition to Duke Cogema Stone & Webster's Motion for Summary Disposition of GANE Contention 3 (Sept. 16, 2003) [hereinafter GANE Opposition].

[6] See supra n.3.

[7] See Georgians Against Nuclear Energy Contentions Opposing a License for Duke Cogema Stone & Webster to Construct a Plutonium Fuel Factory at Savannah River Site (Aug. 13, 2001) at 13-18 [hereinafter GANE Contention 3].

[8] See Memorandum and Order on Contentions, 54 NRC at 429-32.

[9] See id. at 429.

earthquake.[10] After several sets of interrogatories,[11] an unopposed motion to the Board,[12] the submission of a revised CAR,[13] and the deposition of the Intervenor's expert, Dr. Leland Timothy Long,[14] the scope of contention 3 was narrowed by the parties.[15] The current focus of contention 3 is "whether the probabilistic [seismic] hazard analysis . . . prepared by DCS contains an adequate analysis of the likelihood of a severe earthquakes [sic] at the site of the proposed MOX Facility."[16]

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[10] See GANE Contention 3.

[11] DCS served two sets of interrogatories on GANE. See Duke Cogema Stone & Webster's First Set of Interrogatories to Georgians Against Nuclear Energy and Blue Ridge Environmental Defense League (May 31, 2002) [hereinafter First DCS Interrogatories]; Duke Cogema Stone & Webster's Second Set of Interrogatories to Georgians Against Nuclear Energy and Blue Ridge Environmental Defense League (Dec. 6, 2002) [hereinafter Second DCS Interrogatories]. GANE replied to these interrogatories, and supplemented its answers three times. See Georgians Against Nuclear Energy and Blue Ridge Environmental Defense League Objections and Responses to Applicant's First Set of Interrogatories and Request for Protective Order (June 28, 2002) [hereinafter First GANE Interrogatory Responses]; Georgians Against Nuclear Energy's Response to Applicant's Second Set of Interrogatories (Dec. 20, 2002) [hereinafter Second GANE Interrogatory Responses]; Georgians Against Nuclear Energy's and Blue Ridge Environmental Defense League's First Supplemental Response to Applicant's First Set of Interrogatories (Nov. 11, 2002) [hereinafter First GANE Supplemental Interrogatory Response]; Georgians Against Nuclear Energy's Second Supplemental Response to Applicant's First Set of Interrogatories (Dec. 20, 2002) [hereinafter Second GANE Supplemental Interrogatory Response]; Georgians Against Nuclear Energy's Third Supplemental Response to Applicant's First Set of Interrogatories (Mar. 5, 2003) [hereinafter Third GANE Supplemental Interrogatory Response].

[12] See Order dated June 20, 2003 (granting unopposed motion to narrow contention 3); see also Deposition Transcript of Dr. Leland Timothy Long (June 25, 26, 2003) at 403:9-13, 405:11-15, 416:6-417:4 [hereinafter Long Tr.].

[13] See supra n.3.

[14] See Long Tr. 403:9-13, 405:11-15, 416:6-417:4.

[15] See DCS Motion Attach. A (setting out revised GANE Contention 3 based on stipulations of counsel) [hereinafter Revised GANE Contention 3].

[16] GANE Opposition at 2; see infra n.19.

In its motion for summary disposition, DCS dissects GANE's position into three major categories: (1) the challenge to the regulatorily required historical check of the most severe earthquake used by DCS;[17] (2) the challenge to the 0.2 g (where g is the acceleration due to gravity) peak ground acceleration (PGA) used by DCS for the MOX Facility;[18] and (3) the challenge to the Electric Power Research Institute (EPRI) and Lawrence Livermore National Laboratory (LLNL) probabilistic seismic hazard assessment (PSHA) studies used by DCS.[19]

In the challenge to the historical check, GANE argues that the crustal velocity model, known as the Herrmann Crustal Model, improperly models the ground motions at the MOX Facility site from the 1886 Charleston earthquake.[20] Dr. Long, GANE's expert, estimates the error rate in the model is between ten and fifty percent.[21] GANE believes the model used by DCS should have been developed specifically for the crustal path from Charleston to the MOX Facility site, rather than using the Herrmann Crustal model crustal path of Bowman, South Carolina to Atlanta, Georgia.[22]

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[17] See DCS Motion at 20-24.

[18] See id. at 47-50.

[19] See id. at 25-47. DCS's expert, Dr. Carl Stepp, refers to PSHA as a "probabilistic seismic hazard assessment." DCS Motion, Attach. C, Affidavit of Dr. Carl Stepp, ¶ 4 [hereinafter Stepp Aff.]. The NRC Staff's expert, Dr. John Stamatakos, also refers to the PSHAs in the same manner. See NRC Staff's Response to Motion for Summary Disposition Submitted by Duke Cogema Stone & Webster (Sept. 16, 2003) [hereinafter Staff Response], Exh. 1, Affidavit of Dr. John Stamatakos, ¶ 5 [hereinafter Stamatakos Aff.]. GANE's expert, however, refers to PSHA as a "probabilistic safety hazards analyses." See GANE Opposition, Attach. B, Declaration of Dr. Leland Timothy Long Regarding GANE Contention 3 at 2 [hereinafter Long Aff.]. The EPRI and LLNL sponsored PSHAs both use the term "seismic" and that is the proper term. See infra nn.82, 83.

[20] See Long Tr. at 426:3-7.

[21] See id. at 428:7-9.

[22] See id. at 123:11-20.

GANE also challenges the PGA used by DCS to calculate the horizontal ground surface spectrum at 33 hertz (Hz) for the seismic design of the MOX Facility.[23] While admitting that Regulatory Guide 1.60[24] is appropriate in determining the design of the MOX Facility to withstand earthquakes, GANE argues that DCS should have used a higher PGA than 0.2 g.[25] GANE bases this argument on the June 2002 United States Geological Survey Seismic Hazard Maps which show a return frequency of 2,500 years for 0.2 g PGA at the MOX Facility, while DCS's reliance on the EPRI and LLNL PSHAs show a return frequency of 10,000 years.[26]

Finally, GANE has several challenges to DCS's use of the EPRI and LLNL PSHA studies. GANE believes that the studies are inappropriate for site-specific use,[27] and that even if appropriate, the studies are out of date.[28] It presents several arguments as to why the studies need to be updated to account for information that has emerged since they were published. GANE argues that the studies did not adequately consider: (1) the possibility of a large magnitude earthquake occurring in the area of the MOX Facility;[29] (2) a 7.5 magnitude earthquake occurring in the Eastern Tennessee Seismic Zone;[30] (3) additional epicenters for a

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[23] See Second GANE Supplemental Interrogatory Response at 3.1.

[24] See Regulatory Guide 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants" (1973).

[25] See Second GANE Supplemental Interrogatory Response at 3.1 and 3.4; see also Long Tr. at 40:11-13.

[26] See Long Tr. at 413:16-415:1.

[27] See Long Tr. at 175:11-176:1-13.

[28] See GANE Opposition at 9-12.

[29] See id. at 11.

[30] See id.

Charleston-type earthquake;[31] (4) a shorter recurrence interval for Charleston-type earthquakes;[32] (5) an increased magnitude of historical earthquakes in the South Carolina Coastal Plain;[33] and (6) new ground motion attenuation models that might produce higher ground motions for the MOX Facility than those produced by the EPRI and LLNL PSHAs.[34]

Based on GANE's arguments, DCS now seeks summary disposition of contention 3.[35] DCS claims that it is "incontrovertible" that DCS has complied with the regulations in 10 C.F.R. Part 70 that govern the design of the MOX Facility to protect against earthquakes.[36] Because DCS believes that none of the arguments against the seismic design of the MOX Facility presents a genuine issue of material fact, it requests that the Board dispose of contention 3 by summary disposition.[37] The NRC Staff supports DCS's motion.[38]

GANE opposes the motion for summary disposition, claiming DCS has failed to prove that there were no genuinely disputed and material factual issues.[39] GANE further argues that its criticism of DCS's PSHA is "supported by scientific logic and the extensive experience of Dr.

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[31] See id.

[32] See id.

[33] See id.

[34] See id.

[35] See DCS Motion at 2; DCS Reply to GANE Opposition to DCS Motion for Summary Disposition on Contention 3 (Oct. 8, 2003) [hereinafter DCS Reply].

[36] See DCS Motion at 2.

[37] See id.

[38] See Staff Response at 1.

[39] See GANE Opposition at 1; Georgians Against Nuclear Energy's Response to New Facts and Arguments in NRC Staff's Response to Duke Cogema Stone & Webster's Motion for Summary Disposition of GANE Contention 3 (Sept. 26, 2003) [hereinafter GANE Staff Response].

Long, as well as by professional papers."[40] Based on this support, GANE argues: (1) DCS's seismic analysis is significantly flawed;[41] (2) DCS inappropriately relies on the LLNL and EPRI studies;[42] (3) DCS fails to take into account new and site-specific information;[43] and (4) DCS fails to cure its errors through the application of conservatisms.[44]

After the Board granted DCS's request to file a reply, GANE moved to strike it arguing that DCS failed to adhere to its original purpose of clarifying technical statements and responding to previously unidentified documents by GANE.[45] DCS opposed the motion, arguing that DCS's response was proper and necessary to clarify technical statements which mischaracterize the MOX Facility, the work conducted to reach the facility's seismic design, to respond to documents not previously identified by GANE during discovery, and to respond to opinions not previously revealed by GANE during discovery.[46] The Board denied GANE's motion on October 24, 2003.[47]

III. Summary Disposition

Pursuant to the summary disposition provisions of 10 C.F.R. § 2.749, made applicable to Subpart L proceedings by 10 C.F.R. § 2.2, summary disposition is available for all or any

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[40] GANE Opposition at 7.

[41] See id. at 7-8; Long Aff. ¶ 9(a).

[42] See GANE Opposition at 9-11; Long Aff. ¶¶ 7, 9.

[43] See GANE Opposition at 11-12; Long Aff. ¶¶ 9, 18, 41, 43.

[44] See GANE Opposition at 12-13; Long Aff. ¶ 9(e).

[45] See Georgians Against Nuclear Energy's Motion to Strike DCS' Reply to GANE's Opposition to DCS' Motion for Summary Deposition of GANE Contention 3 or, in the Alternative, Request for Leave to File Surreply at 1-2 (Oct. 16, 2003).

[46] See DCS Reply to GANE's October 16, 2003 Motion to Strike at 2 (Oct. 21, 2003).

[47] See Order (Oct. 24, 2003) (unpublished).

matters in a proceeding "if the filings in the proceeding, depositions, answers to interrogatories, and admissions on file, together with the statements of the parties and the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a decision as a matter of law."[48] The Commission has held that summary disposition motions under 10 C.F.R. § 2.749 are analogous to summary judgment motions under Rule 56 of the Federal Rules of Civil Procedure and should be evaluated under the same standards.[49] Under both NRC and federal case law, the party seeking summary disposition bears the burden of showing the absence of a genuine issue of material fact.[50] Because the burden of proof is on the movant, "the evidence submitted must be construed in favor of the party in opposition thereto, who receives the benefit of any favorable inferences that can be drawn."[51] Despite the burden on the movant, the party opposing summary disposition must set forth specific facts showing that there is a genuine issue.[52] To be considered genuine, "the factual record, considered in its entirety, must be enough in doubt so that there is a reason to hold a hearing to resolve the issue."[53]

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[48] 10 C.F.R. § 2.749(d).

[49] See Advanced Med. Sys., Inc. (One Factory Row, Geneva, Ohio 44041), CLI-93-22, 38 NRC 98, 102 (1993).

[50] See Adickes v. Kress & Co., 398 U.S. 144, 157 (1970); Advanced Med. Sys., Inc., CLI-93-22, 38 NRC at 102.

[51] Sequoyah Fuels Corp. and General Atomics (Gore, Oklahoma Site Decontamination and Decommissioning Funding), LBP-94-17, 39 NRC 359, 361, aff'd CLI-94-11, 40 NRC 55 (1994).

[52] See 10 C.F.R. § 2.749(b).

[53] Cleveland Elec. Illuminating Co. (Perry Nuclear Power Plant, Units 1 & 2), LBP-83-46, 18 NRC 218, 223 (1983).

If there is a likelihood that a genuine issue of fact exists to be litigated, or if there is doubt as to whether the parties should be required to proceed further, the motion should be denied.[54] On the other hand, if the non-moving party fails to oppose any material fact properly set out in the moving party's statement of material facts that accompany the summary disposition motion, then that fact will be deemed admitted.[55] After the moving party makes a proper showing for summary disposition, and the non-moving party does not establish a genuine issue of material fact, then the Board may summarily dispose of the contention on the basis of the pleadings.[56]

Under Rule 56, federal case law makes clear that summary judgment is not appropriate where it would require a determination of the credibility of witnesses.[57] In the present case, where the opinions of two experts may appear to be in conflict with each other, Federal Rule of Evidence 702 may also serve as guidance in determining whether Dr. Long's opinions preclude summary disposition of contention 3.[58] Under Rule 702, a witness qualifies as an expert by "knowledge, skill, experience, training, or education."[59] An opinion of an expert is admissible only if: (1) the opinion would assist the trier of facts in understanding the evidence or to

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[54] See General Elec. Co. (GE Morris Operation Spent Fuel Storage Facility), LBP-82-14, 15 NRC 530, 532 (1982).

[55] See 10 C.F.R. § 2.749(a); Advanced Med. Sys., Inc., CLI-93-22, 38 NRC at 102-03.

[56] See N. States Power Co. (Prairie Island Nuclear Generating Plant, Units 1 and 2), CLI-73-12, 6 AEC 241, 242 (1973), aff'd sub. nom., BPI v. AEC, 502 F.2d 424 (D.C. Cir. 1974).

[57] See, e.g., Leonard v. Dixie Well Serv. & Supply, Inc., 828 F.2d 291, 294 (5th Cir. 1987); Neely v. St. Paul Fire and Marine Ins. Co., 584 F.2d 341, 344 (9th Cir. 1978).

[58] See Philadelphia Elec. Co. (Limerick Generating Station, Units 1 and 2), ALAB-819, 22 NRC 681, 732 n.67 (1985) (citing Fed. R. Evid. 702); see also Duke Power Co. (William B. McGuire Nuclear Station, Units 1 and 2), ALAB-669, 15 NRC 453, 475 (1982).

[59] Fed. R. Evid. 702.

determine a fact in issue; and (2) the opinion is based upon sufficient facts or data to be the product of reliable principles and methods which the witness applied to the facts of the case.[60] While the expert's method for forming his opinion need not be generally recognized in the scientific community, the opinion must be based on the "methods and procedures of science" rather than on "subjective belief or unsupported speculation."[61]

While the courts have applied Rule 702 liberally by favoring the admission of any evidence to assist the trier of fact,[62] the applicable substantive law in the present case, 10 C.F.R. § 70.23(b), governs what factual disputes are material in a proceeding. Real disputes over facts that might affect the outcome of the case will most likely preclude the entry of summary judgment.[63] Where there is a disagreement among competing experts over material facts, summary judgment may not be appropriate if it would require the trier of fact to "untangle the expert affidavits and decide 'which experts are more correct.' "[64] In that case, a hearing, if permitted by the applicable procedures, is the appropriate forum for the trier of fact to weigh the competing expert opinions on material facts.[65]

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[60] Id.

[61] Daubert v. Merrell Dow Pharm., 509 U.S. 579, 589-90 (1993).

[62] See Kannankeril v. Terminix Int'l, 128 F.3d 802, 806 (3d Cir. 1997); Holbrook v. Lykes, 80 F.3d 777, 780 (3d Cir. 1996); In re Paoli R.R. Yard PCB Litig., 35 F.3d 717, 741-43 (3d Cir. 1994).

[63] See Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 248 (1986).

[64] Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-01-39, 54 NRC 497, 510 (2001) (citing Norfolk S. Corp. v. Oberly, 632 F. Supp. 1225, 1243 (D. Del. 1986), aff'd on other grounds, 822 F.2d 388 (3d Cir. 1987)).

[65] See Private Fuel Storage, L.L.C., LBP-01-39, 54 NRC at 510 (citing Kannankeril v. Terminix Int'l, 128 F.3d at 807).

Conflicting expert opinions, however, do not necessarily preclude summary disposition. In determining whether summary judgment is appropriate, the trier of fact must focus on whether the expert opinions are sufficiently grounded upon a factual basis.[66] Bare assertions and general denials are insufficient to defend against a properly supported motion for summary disposition.[67] Likewise, "quotations from or citations to [the] published work of researchers who have apparently reached conclusions at variance with the movant's affiants" likely will be insufficient to defeat a motion for summary disposition.[68] Thus, the non-moving party cannot avoid summary judgment by presenting an unsupported opinion of an expert.[69] Expert opinion is admissible only if the affiant is competent to give an expert opinion and only if the factual basis for that opinion is adequately stated and explained in the affidavit.[70] This latter point takes on added significance in an informal Subpart L proceeding such as this one under the old rules in which no party has a right to cross-examine any other party's expert at a subsequent trial. Rather, the parties only have the right to file written presentations supported by affidavits and documentary material with the possibility of the presiding officer questioning the parties'

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[66] See Bragdon v. Abbott, 524 U.S. 624, 653 (1998); Kannankeril v. Terminix Int'l, 128 F.3d at 807.

[67] See 10 C.F.R. § 2.749(b); Advanced Med. Sys., Inc., CLI-93-22, 38 NRC at 102; Houston Lighting and Power Co. (Allens Creek Nuclear Generating Station, Unit No. 1), ALAB-629, 13 NRC 75, 81 (1981); Yankee Atomic Elec. Co., LBP-96-18, 44 NRC 86, 103 (1996).

[68] Carolina Power & Light Co. and N. Carolina E. Mun. Power Agency (Shearon Harris Nuclear Plant, Units 1 and 2), LBP-84-7, 19 NRC 432, 435-36 (1984).

[69] See United States v. Various Slot Mach. on Guam, 658 F.2d 697, 700 (9th Cir. 1981); Rohrbough by Rohrbough v. Wyeth Lab., Inc., 719 F. Supp. 470, 475 (N. D. W. Va. 1989), aff'd on other grounds, 916 F.2d 970 (4th Cir. 1990); State Farm Fire and Cas. Co. v. Miles, 730 F. Supp. 1462, 1473 (S.D. Ind. 1990), aff'd, 930 F.2d 25 (7th Cir. 1991).

[70] See Garside v. Osco Drug, Inc., 895 F.2d 46, 50 (1st Cir. 1990); United States v. Various Slot Mach. On Guam, 658 F.2d. at 700.

experts at an oral session.[71] In such circumstances, the non-moving party and its expert, in opposing summary disposition, must clearly and thoroughly explain the basis for the expert's opinion.

IV. Applicable Regulations

In order to receive approval for construction of the MOX Facility, DCS must satisfy 10 C.F.R. §§ 70.23(a)(3), 70.23(b), and 70.64(a)(2). Pursuant to § 70.23(a)(3), the NRC must determine whether the "applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property." Under § 70.23(b), the NRC must determine whether the "design bases of the principal structures, systems, and components . . . provide reasonable assurance of protection against natural phenomena." Finally, § 70.64(a)(2) requires that the facility design "must provide for adequate protection against natural phenomena with consideration of the most severe documented historical events for the site."

The NRC Staff provides guidance for compliance with the regulatory standards in the MOX Standard Review Plan.[72] NUREG-1718 recommends a "risk informed" approach to the evaluation of natural hazards, and recommends that the applicant consult various other NRC guidance documents, including Regulatory Guide 1.165, Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion (1997). NUREG-1718 also contemplates that the applicant will use probabilistic seismic analyses.[73] Additionally, NUREG-1718 states that other Regulatory Guides for nuclear power reactors

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[71] See 10 C.F.R. §2.1233; CLI-01-13, 53 NRC at 482.

[72] See Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility (NUREG-1718) (Aug. 2000) [hereinafter NUREG-1718].

[73] See NUREG-1718, App. B, B-1.

"provide useful reference information," so the applicant may look to those for guidance as well.[74]

V. Background of DCS's Seismic Analyses

1. Background of EPRI and LLNL PSHAs

In its seismic design of the MOX Facility,[75] DCS relied on the EPRI and LLNL PSHA studies and the Savannah River Site (SRS)-specific seismic design published in 1997 by the Westinghouse Savannah River Corporation (WSRC).[76] A PSHA is an analytical methodology that quantifies the probability of exceeding various ground motion levels at a given location during a certain amount of time, usually one year.[77] In making the hazard calculation, the methodology uses a weighted combination of seismic sources, source parameters such as magnitude and recurrence frequency, and ground motion models.[78] Because the inputs into the calculation are weighted, and various experts might be expected to assign different weights to seismic sources and source parameters, and may rely, to differing degrees, on applicable ground motion models, the experts' conclusions can vary greatly.[79] Therefore, a complete PSHA takes into account alternative inputs prepared by many different experts.[80] The inputs

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[74] Id.

[75] DCS Motion at 7.

[76] See R.C. Lee et al, SRS Seismic Response Analysis and Design Basis Guidelines WSRC-TR-97-0085, Rev. 0 (1997).

[77] DCS Motion at 8.

[78] See id.

[79] See id.

[80] See id.

may be site-specific or may be done for a large geographic region and then applied to many sites of interest within that geographic area.[81]

Two independent PSHA studies have been conducted for nuclear facilities in the United States east of the Rocky Mountains. The studies were conducted simultaneously by LLNL on behalf of the NRC,[82] and by EPRI, on behalf of the nuclear utilities.[83] Both studies used multiple experts[84] to determine the various inputs used in the calculations, and while the studies differ primarily in the methodology used to obtain the inputs and assessments of uncertainty, both are accepted by the NRC Staff as suitable for developing a site-specific PSHA.[85]

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[81] See id.

[82] See D.L. Bernreuter et al., Seismic Hazard Characterization of 69 Nuclear Plant Sites East of the Rocky Mountains, NUREG/CR-5250 (Jan. 1989); P. Sobel, Revised Livermore Seismic Hazard Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains, NUREG-1488 (April 1994); J.B. Savy et al., Eastern Seismic Hazard Characterization Update, UCRL-ID-115111 (June 1993) [hereinafter LLNL PSHA].

[83] See EPRI, Probabilistic Seismic Hazard Evaluations at Nuclear Plant Sites in the Central and Eastern United States, NP-4726, All Volumes (1989-1991) [hereinafter EPRI PSHA].

[84] The LLNL PSHA used approximately ten experts to evaluate seismic sources and seven experts to assess uncertainty in ground motion estimation. See Stepp Aff. ¶ 13. The experts' conclusions were obtained for the central and eastern United States and covered sixty-nine nuclear power plant sites. See id. The study combined the alternative seismic sources uncertainty distributions with the ground motions estimation uncertainty distributions to compute the ground motion hazard at these sites. See id. The EPRI study used six expert teams to evaluate alternative seismic sources and characterize seismic source parameters. See id. ¶ 14. The EPRI study relied on ground motion input prepared by EPRI consultants and two additional ground motion models for the central and eastern United States. See id.

[85] See Stepp Aff. ¶ 12; see also U.S. NRC, Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion, Reg. Guide 1.165, pp. 2-3 (Mar. 1997). The U.S. Department of Energy also accepts these studies. See U.S. Department of Energy, Natural Phenomena Hazards Assessment Criteria, DOE-STD-1023-95, Change Notice No. 1, p. 6 (Section 3.1.2.1) (Jan. 1996) [hereinafter DOE-STD 1023-95].

The EPRI and LLNL PSHAs are applied by entering a site's latitude and longitude into the elected study's computer code, computing the contribution of individual seismic source hazards for that specific site, and then aggregating the results to calculate the probability distribution of exceeding various levels of ground motion.[86] The probability distribution of annual frequency of exceedance for a specific ground motion is the probabilistic seismic hazard output.[87] The hazard is computed for peak ground acceleration and acceleration over a range of frequencies that are critical for the structural design of the proposed facility.

2. DCS's Site-specific Seismic Analyses

DCS relied on a 1997 SRS-specific seismic response analysis performed by WSRC that took into consideration local properties such as soil column thickness, soil and bedrock shear-wave velocity, and soil dynamic properties and used the bedrock outcrop hazards in the EPRI and LLNL PSHAs for the latitude and longitude for the site.[88] The SRS-specific analysis that DCS relied upon used an average of the LLNL and EPRI PSHA curves to obtain design basis ground motions.[89]

DCS then applied the SRS-specific analyses to separately generated seismic design basis ground motions by performance category (PC). According to DCS, the proposed MOX Facility has four performance categories based on a performance goal stated in terms of acceptable damage to office buildings at PC-1 and structures, systems and components that

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[86] See Stepp Aff. ¶ 15.

[87] See id.

[88] See id. ¶ 17; see also R.C. Lee et al., SRS Seismic Response Analysis and Design Basis Guidelines, WSRC-TR-97-0085, Rev. 0 (1997); R.C. Lee, Soil Surface Seismic Hazard and Design Basis Guidelines for Performance Category 1 & 2 SRS Facilities, WSRC-TR-98-00263, Rev. 0 (1998).

[89] See Stepp Aff. ¶ 17.

have radiological protection safety significance for a nuclear facility at PC-3 and PC-4.[90] DCS states that, in the seismic analyses, the performance goals for the different PCs are examined for a combination of the seismic design basis ground motion and the seismic design criteria.[91] DCS states that to ensure the facility meets its desired performance goal, each analyzed seismic design basis ground motion must take into account the inherent probability of occurrence associated with it.[92] Accordingly, DCS declares that combining the seismic design basis ground motions with the deterministic seismic design criteria provides reasonable assurance that the PC will perform as intended.[93]

DCS explains that peak ground acceleration only becomes a factor in the higher vibrational frequency events that are usually at vibrational frequencies above the levels that may cause damage to the structures at nuclear facilities.[94] For example, PC-3 has a peak ground acceleration at the surface of 33 Hz. None of the safety structures at the MOX Facility, DCS claims, resonates at this frequency; rather, they resonate at frequencies between 2.5 and 9 Hz.[95]

VI. Analysis

GANE challenges the adequacy of the historical check DCS used for the MOX Facility. It also challenges the use of 0.2 g effective PGA used by DCS in determining the horizontal ground surface spectrum for the seismic design of the MOX Facility. Finally, GANE challenges

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[90] See DCS Motion at 11.

[91] See id.

[92] See id. at 12.

[93] See id.

[94] See id.

[95] See id.

DCS's use of the EPRI and LLNL PSHAs in determining site-specific seismic criteria for the facility.

1. Adequacy of the Historical Check

The MOX Facility is located on the inland border of South Carolina and Georgia.[96] In accordance with 10 C.F.R. § 70.64(a)(2), the historical check, that is, the most severe documented historical seismological event, is represented by a repeat of the 1886 Charleston earthquake (1886 earthquake) placed 120 kilometers southeast of the site with a moment magnitude of 7.3.[97] With the 1886 earthquake as background, DCS planned the seismic design basis ground motions for PC-3 to envelope the ground motions of historical earthquakes within 200 kilometers from the site equal to or larger than magnitude 6.0, using the calculated ground motions at the site of the 1886 earthquake.[98]

In order to determine the ground motions at the site of the 1886 earthquake, DCS used the Herrmann Crustal Model, which uses a seismic wave attenuation path from Bowman, South Carolina to Atlanta, Georgia, and simulates the earth's crust with four layers on top of an infinite underlying layer.[99] DCS modified the Herrmann Crustal Model by removing the shallowest layer, thereby creating three layers over an infinite layer, to create better agreement with the

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[96] See id. at 13, and Attach. D (modified from Revised CAR at 1.3.5-34).

[97] See DCS Motion at 13.

In the summary disposition filings, the parties use the term "moment magnitude." That term refers to a scale introduced by Hiroo Kanamori that is a succession to the more commonly known Richter magnitude scale. Like other magnitude scales, the moment magnitude scale is used by seismologists to compare the energy released by earthquakes and it roughly agrees with the magnitude estimates of other such scales. See generally Katsuyuki Abe, Magnitudes and Moments of Earthquakes, Global Earth Physics, A Handbook of Physical Constants (Thomas J. Ahrens ed., 1995) at 207.

[98] See DCS Motion at 13; DOE-STD-1023-95, p. 11 (Section 3.1.5).

[99] See DCS Motion at 13.

local shallow bedrock velocity data.[100] It used a separate model to account for the Mohorovicic discontinuity, or Moho Bounce, an effect where the seismic waves reflect off the boundary between the earth's crust and mantle (dubbed "the Moho"), placing the Moho at a depth of about 29 kilometers (km).[101] DCS asserts that a 7.3 moment magnitude earthquake with an epicenter located 120 kilometers southeast of the MOX Facility is appropriate or conservative for modeling the historic 1886 earthquake.[102]

While it is undisputed that the 1886 earthquake was the most severe documented historical earthquake,[103] GANE has several concerns with DCS's application of the crustal velocity model to the historical check. First, GANE argues that, based on the opinion of its expert, Dr. Long, the assumption of a 7.3 moment magnitude earthquake with an epicenter located 120 kilometers southeast of the MOX Facility site is neither robust nor conservative.[104] Dr. Long bases his opinion on the assertion that effects like the Moho Bounce increase shaking with increased distance.[105] Further, Dr. Long estimates that the use of the Herrmann Crustal Model may produce erroneous ground motions with an error rate as much as 50 percent.[106] As

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[100] See id. at 13-14.

[101] See id. at 14; Stepp Aff. ¶ 24.

[102] See DCS Motion, Attach. B, Statement of Material Facts On Which No Genuine Issue Exists in Support of DCS Motion for Summary Disposition on Contention 3, ¶ 3 [hereinafter DCS Undisputed Material Facts].

[103] See First GANE Interrogatory Responses 3.32; Long Tr. at 129:10-15; see also Revised CAR at 1.3.6-27; GANE Opposition, Attach. A, GANE's Statement of Genuinely Disputed Material Facts ¶ 1 [hereinafter GANE Disputed Material Facts].

[104] See GANE Opposition at 2; Long Aff. ¶¶ 8, 56.

[105] See Long Aff. ¶ 56; GANE Disputed Material Facts ¶ 1.

[106] See Long Aff. ¶ 57; GANE Disputed Material Facts ¶ 2.

GANE notes, Dr. Long bases this determination on "an educated guess."[107] Consequently, GANE argues, DCS needs to recalculate the seismic hazards using current and site-specific information in order to provide a reasonably reliable PSHA.[108] It is not appropriate, GANE continues, for DCS to err in its calculations and then correct possible mistakes by introducing a "so-called conservatism."[109]

In response, DCS notes that Dr. Long has twice referred to the 120 kilometer epicenter as "realistic."[110] "Realistic," DCS argues, is synonymous with "appropriate."[111] DCS continues by asserting that Dr. Long's argument against placing the epicenter 120 kilometers from the MOX Facility is a new argument not previously revealed by GANE during discovery.[112] In any event, DCS states that GANE fails to dispute that the "Moho Bounce is only important for earthquakes which have epicenters located between about 80 and 120 [kilometers] from the MOX Facility."[113] It also asserts that Dr. Long admitted that the Moho Bounce has its maximum effect at 100 kilometers from the epicenter.[114]

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[107] GANE Disputed Material Facts ¶ 2.

[108] See GANE Opposition 7-8; GANE Disputed Material Facts ¶ 2.

[109] GANE Disputed Material Facts ¶ 2.

[110] See DCS Motion at 21 and n.72; Long Tr. at 190:1-6, 13-14. In this regard, Dr. Long responded during his disposition to the question whether, for purposes of the historical check, he believed that there were any inadequacies in the location used in the CAR for a repeat of the 1886 Charleston earthquake by stating "[n]o, that would be realistic." Long Tr. at 190:5-6. See also Long Tr. at 130:3-5 (where Dr. Long responds that the moment magnitude of the 1886 Charleston earthquake was "[p]robably around 7.0").

[111] See DCS Reply at 6.

[112] See id.

[113] Id. (quoting DCS Undisputed Material Facts ¶ 44); see Long Aff. ¶ 22.

[114] See DCS Reply at 6; Long Tr. at 220:9-14.

Based on these arguments, plus the analyses of its own expert, Dr. Stepp, DCS argues that placing the epicenter any further away than 120 kilometers from the MOX Facility would result in computing smaller (less conservative) ground motions.[115] Conversely, DCS asserts that placing the epicenter any closer than 120 kilometers is also not appropriate because an adequate historical check uses the most significant historical seismic event, the 1886 earthquake that places the epicenter at 120 kilometers from the MOX Facility.[116]

DCS further notes that GANE does not dispute DCS Undisputed Material Facts ¶¶ 4-9, that state, inter alia, that the horizontal ground surface spectrum for the MOX Facility uses the Regulatory Guide 1.60 spectrum anchored at 0.2 g PGA, and that even if the ground motions in the historical check of the PC-3 spectrum were increased by 50 percent above the 1886 earthquake, the MOX spectrum still envelopes the increased ground motion for all frequencies relevant to the structural integrity of the MOX Facility (i.e., at between 2.5 and 9 Hz).[117] At best, DCS argues, GANE has only suggested that the historical check relied upon by DCS is incorrect. Without providing any verification or quantification to such claims, DCS continues, GANE then asserts that correcting the erroneous historical check would yield increased ground motions of 10-50 percent. In addition to urging that this hypothesis lacks foundation, DCS asserts that the MOX spectrum is nevertheless conservative enough to envelope GANE's suggested increased ground motions.[118] DCS concludes therefore that the historical check is appropriate and satisfies the requirements of 10 C.F.R. § 70.64(a)(2).

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[115] See DCS Reply at 6; id., Supplemental Affidavit of Dr. Carl Stepp ¶¶ 9, 10 [hereinafter Stepp Supplemental Aff.].

[116] See DCS Reply at 6; Stepp Supplemental Aff. ¶ 10.

[117] See DCS Reply at 7; DCS Undisputed Material Facts ¶¶ 4-9.

[118] See DCS Reply at 7-8, DCS Undisputed Material Facts ¶ 9; Stepp Supplemental Aff. ¶ 11.

Pursuant to that regulatory provision, an applicant for a new facility must design the facility to "provide for adequate protection against natural phenomena with consideration of the most severe documented historical events for the site."[119] Both GANE and DCS agree that the most significant historical event to be considered in the design of the MOX Facility is the 1886 earthquake.[120] The parties do not agree, however, on whether a 7.3 moment magnitude earthquake with an epicenter located 120 kilometers southeast of the MOX Facility site is appropriate or conservative for modeling the historic 1886 earthquake's ground motions.[121] GANE's expert, Dr. Long, has twice admitted, however, that placing the epicenter of the 1886 earthquake 120 kilometers from the MOX Facility is "realistic."[122] In the circumstances presented, as DCS claims, we conclude that "realistic" is synonymous with "appropriate."

Because § 70.64(a)(2) requires that the applicant take into consideration the most severe documented historical event in designing its facility, and both parties agree that the most significant event is the 1886 earthquake, DCS needs only to provide a "realistic," i.e., an accurate interpretation, of the earthquake and its potential effects on the MOX Facility to satisfy § 70.64(a)(2). Thus, *in terms of the regulation*, GANE cannot logically argue both that DCS's consideration of the 1886 earthquake is realistic (i.e., an accurate portrayal of the 1886 earthquake) but that DCS's consideration of it is not appropriate.

Moreover, GANE's argument fails to present any genuine issue of material facts for the Board to adjudicate regarding the adequacy of DCS's historical check within the meaning of the regulation. GANE argues that it is not necessarily conservative to place the epicenter of the

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[119] 10 C.F.R. § 70.64(a)(2).

[120] See supra n.104; see also DCS Undisputed Material Facts ¶ 2.

[121] See DCS Undisputed Material Facts ¶ 3; GANE Disputed Material Facts ¶ 1.

[122] See supra n.110 and accompanying text.

1886 earthquake at 120 kilometers from the MOX Facility because of the Moho bounce. Because GANE does not dispute DCS's assertion of fact that the "Moho bounce is only important for earthquakes which have epicenters located about 80 to 120 [kilometers] from the MOX facility," that fact is deemed admitted.[123] Additionally, GANE's expert admits that the Moho bounce has its maximum effect at 100 kilometers away from the MOX Facility.[124] Thus, DCS is correct that placing the epicenter at a distance greater than 120 kilometers from the MOX Facility would not produce any more conservative ground motions than an epicenter placed at 120 kilometers. Further, because both parties agree that the 1886 Charleston earthquake is the most significant historical event for the MOX facility, and the facility is 120 kilometers from the epicenter of that event, DCS is correct in placing the epicenter at the point that coincides with the highest reported historical ground shaking effects from the 1886 earthquakes.

GANE's argument also lacks foundation in that Dr. Long suggests that the impact of DCS's alleged errors would increase the ground motion by as much as 50 percent, but he fails to provide a scientific explanation for this occurrence; rather, GANE concedes that Dr. Long was making an "educated guess." In determining whether conflicting expert testimony necessarily precludes summary disposition, the Board must focus on whether the experts' opinions are sufficiently grounded upon facts.[125] By merely stating that the error rate could be as high as 50 percent, without providing a factual basis for his opinion, Dr. Long fails to provide the foundation necessary to support his claim. Because bare assertions and general denials

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[123] See DCS Undisputed Material Facts ¶ 44; 10 C.F.R. § 2.749(a).

[124] Long Tr. at 220:13-14.

[125] See supra nn.66, 70.

are insufficient to defend against a properly supported motion for summary disposition,[126] Dr. Long's educated guess does not create a genuine issue of material fact that will defeat DCS's motion for summary disposition.

Finally, and most importantly, even were Dr. Long's opinion adequately supported, the MOX Facility's seismic design is sufficiently conservative to envelope a 50 percent increase in postulated ground motions. Assuming arguendo, that GANE is correct in asserting that DCS's error rate is as high as 50 percent, the historical ground motions produced by the 1886 earthquake still would be enveloped by the seismic design basis spectrum for all frequencies of structural interest (i.e., 2.5 and 9 Hz). Thus, as the Staff agrees,[127] DCS is correct that the MOX Facility design maintains its integrity for ground motions well beyond those of the 1886 earthquake. Thus, GANE has failed to establish any genuine issue of material fact regarding the accuracy of the historical check for the MOX Facility or that DCS's historical check does not meet the requirements of 10 C.F.R. § 70.64(a)(2).

2. Adequacy of 0.2 g Effective PGA Used by DCS to Determine the Horizontal Ground Surface Spectrum for the Seismic Design of the MOX Facility

In its motion for summary disposition, DCS addresses GANE's apparent challenge— contained in GANE's interrogatory answers— to the 0.2 g effective PGA used by DCS to anchor the Regulatory Guide 1.60 horizontal ground surface spectrum at 33 Hz for the seismic design of the MOX Facility.[128] But GANE's opposition to DCS's summary disposition motion is silent with respect to support for this purported challenge. Rather, GANE's opposition merely states that "[t]ime and space constraints do not permit GANE to rehearse each of DCS's

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[126] See supra n.67.

[127] See Staff Response at 9.

[128] See DCS Motion at 47-48.

technical arguments in this response."[129] Similarly, GANE's statement of disputed material facts and the affidavit of Dr. Long make little more than passing reference to its apparent challenge.[130] Thus, GANE's failure in its opposition to DCS's summary disposition motion to articulate adequately and understandably its challenge in this regard is grounds to dismiss any such challenge. Although unnecessary in these circumstances, we nevertheless for the sake of completeness attempt to address GANE's purported challenge as best we can discern it.

In its summary disposition motion, DCS initially notes that Dr. Long disagrees with using the United States Geological Survey (USGS) maps for site-specific purposes.[131] According to DCS, this fact alone invalidates GANE's use of the USGS seismic hazard maps because their own expert does not believe the maps are appropriate for site-specific use; therefore this matter cannot involve a genuine issue of material fact.[132] Additionally, DCS argues that the seismic hazard maps developed by USGS cannot meaningfully be compared with the seismic hazard developed for the MOX Facility.[133] DCS states that the USGS seismic hazard map ground motions are developed using site condition assumptions characterized by USGS as "firm-rock."[134] Dr. Stepp asserts that firm-rock is prevalent in the western United States, but does not exist beneath, or in the vicinity of, the MOX Facility; rather, "hard-rock" exists below the MOX Facility.[135] He states that this distinction is significant because firm-rock and hard-rock have

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[129] See GANE Opposition at 7.

[130] See GANE Disputed Materials Facts ¶¶ 31-33; Long Aff. ¶¶ 70-71.

[131] See DCS Motion at 48; see also Long Tr. at 35:19-20-36:1-4.

[132] See DCS Motion at 48.

[133] See id.

[134] See id.

[135] See Stepp Aff. ¶ 75.

significantly different shear-wave velocities and applying the firm-rock assumptions to a hard-rock site overestimates the ground motions at the site and leads to a decrease in the return period for a given peak acceleration.[136] DCS claims that this variation is consistent with the results GANE found using the USGS hazard maps which suggest a return rate of 2500 years rather than 10,000 years for 0.2 g PGA.[137]

DCS also points to several other differences that make the USGS hazard maps inappropriate for site-specific use, including the depth to rock, the soil properties, and bedrock material properties at the proposed site.[138] It asserts that the 1997 SRS-specific seismic analysis DCS relied upon takes into account the unique site characteristics of the MOX Facility, while the USGS hazard maps relied on by GANE do not.[139] This distinction is fundamental, DCS argues, because site-specific soil conditions strongly affect earthquake ground motions.[140] Thus, DCS points out that an accurate seismic analysis must model the soil and bedrock as close to the actual geology at the MOX Facility site as possible and the USGS maps do not take into account the site-specific geology.[141] Finally, DCS notes that the methodology used to make the USGS seismic hazard maps was less structured than, and differs significantly from, the methodologies used by EPRI and LLNL for assessing ground motion hazards for the seismic design and risk assessment of nuclear facilities.[142] DCS concludes that a comparison

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[136] See id. ¶ 76.

[137] See DCS Motion at 49; Stepp Aff. ¶ 76.

[138] See DCS Motion at 49; Stepp Aff. ¶ 77.

[139] See DCS Motion at 49.

[140] See DCS Motion at 49; Stepp Aff. ¶ 77.

[141] See DCS Motion at 49; Stepp Aff. ¶ 77.

[142] See DCS Motion at 50.

of the USGS national seismic hazard maps to the MOX spectrum is like comparing "apples and oranges."[143] Consequently, DCS claims that the issue fails to raise a genuine issue of material fact and should be disposed of by summary disposition.[144]

As previously noted, GANE's opposition to DCS's summary disposition motion does not respond to, or directly dispute, most of these DCS assertions. Rather, in its statement of disputed material facts, which are taken nearly verbatim from Dr. Long's affidavit, GANE merely states that the computation of the 2500 year return period from the USGS hazard maps and that of 10,000 years from the PSHAs used by DCS should not be so different and that the statistical relation between the two should differ only slightly, not by a factor of four.[145] With respect to DCS's hard-rock/firm-rock distinction, GANE's statement reiterates Dr. Long's affidavit which states, without elaboration, that this is not a simple issue and that, in effect, he would have to see how the data used by USGS figured into its computations to determine whether USGS's firm-rock assumptions for a hard-rock site overestimate the ground motions for the MOX Facility.[146]

GANE appears to base its challenge to DCS's use of a 0.2 g effective PGA on Dr. Long's comparison of data from the USGS seismic hazard maps with the MOX Facility spectrum.[147] Although apparently conceding that the Regulatory Guide 1.60 spectral shape is

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[143] Id.

[144] See id.

[145] See GANE Disputed Material Facts ¶ 31; see also Long Aff. ¶ 70.

[146] See Long Aff. ¶ 71; see also GANE Disputed Material Facts ¶ 33.

[147] At his deposition, Dr. Long stated he obtained the seismic hazard maps from the USGS website. See Long Tr. at 414:22-415:1. GANE did not make the USGS hazard maps an exhibit to its opposition to DCS' summary disposition motion.

appropriate for the MOX Facility,[148] GANE asserts that the June 2002 version of the USGS maps show, in the area of the proposed facility, a return rate for 0.2 g PGA of about 2500 years.[149] GANE then asserts, without more, that the hazard reported by the USGS maps is larger than the one DCS has assigned to the MOX Facility.[150] Neither GANE nor Dr. Long specify what the higher PGA should be.[151]

In its reply, DCS argues that GANE underestimates the robustness of the Regulatory Guide 1.60 spectrum that DCS used as the horizontal ground surface spectrum for the seismic design basis for the MOX Facility.[152] Although Regulatory Guide 1.60 defines the PGA for 0.2 g at 33 Hz for the MOX Facility, DCS states that the ground acceleration for the frequencies of practical structural interest are significantly higher than 0.2 g.[153] DCS notes that the MOX Spectrum envelopes 0.5 g for 9 Hz and 0.6 g for 2.5 Hz, and that this conservatism, which GANE fails to demonstrate is inappropriate, is inherent in the Regulatory Guide 1.60 spectral shape used as the horizontal surface spectrum for the MOX Facility.[154]

The Staff agrees with DCS that GANE has failed to show how the higher hazard predicted by the USGS Seismic Hazard Maps would materially affect the seismic safety of the MOX Facility.[155] While the Staff's expert, Dr. John Stamatakos, disagrees with DCS's expert,

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[148] See Long Tr. at 40:11-13.

[149] See GANE Disputed Material Facts ¶ 31.

[150] See id.

[151] See Long Tr. at 133:1-5; 183:1-5.

[152] See DCS Reply at 22.

[153] See id.

[154] See id.

[155] See Staff Response at 12.

Dr. Stepp, about the general utility of USGS hazard maps,[156] Dr. Stamatakos does agree with Dr. Stepp that GANE fails to address the ground frequencies which would affect the safety of any PC-3 or PC-4 structures at the MOX Facility.[157] As Dr. Stamatakos notes, Dr. Long has failed to show how the higher hazard predicted by using the USGS maps would materially affect the seismic safety of the MOX Facility. Dr. Stamatakos claims that GANE has failed to demonstrate how the higher hazard predicted using the USGS maps would prevent DCS from complying with the regulatory requirements of 10 C.F.R. §§ 70.61(b) and 70.62(a)(2).[158]

As DCS argues, it is indeed incongruous for Dr. Long to disagree with the use of USGS seismic hazard maps for a specific site and then foot his purported challenge to DCS's use of 0.2 g effective PGA in its seismic analysis for the MOX Facility on just such use. Necessarily, therefore, GANE's challenge to this aspect of DCS's seismic analysis does not raise a genuine issue of material fact.

Even putting to one side Dr. Long's concession that USGS seismic hazard maps should not be used for a specific site, GANE does not directly challenge, as it must to avoid summary disposition, DCS's use of a 10,000 year return period for the 0.2 g PGA at the MOX Facility. Rather, GANE points to the USGS seismic hazard maps, which it did not even file as exhibits to its summary disposition opposition, and argues, in effect, that the maps suggest that DCS should have used a higher PGA. Nowhere, however, does GANE specify what the higher PGA should be and Dr. Long states no opinion on the matter. Similarly, Dr. Long does not directly contest DCS's assertions that the USGS hazard maps are based upon firm-rock assumptions that are inapplicable to the MOX Facility site. Rather, GANE, in effect, pleads it would need

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[156] See Stamatakos Aff. ¶ 27.

[157] See id. ¶ 29.

[158] See id.

more information on the issue from the USGS maps upon which it chose to rely. Pursuant to 10 C.F.R. § 2.749(b), it is incumbent upon GANE to set forth specific supported facts directly controverting DCS's position on each of these matters in order to avoid summary disposition. Finally, and equally important, GANE has not shown how the higher hazard predicted using the USGS maps would materially affect the seismic safety of the MOX Facility for the frequencies of practical structural interest. This being so, GANE has not established any genuine issue of material fact that must be further adjudicated with respect to DCS's use of 0.2 g effective PGA for the MOX Facility.

3. Challenge to the EPRI and LLNL PSHA Studies

GANE also presents several challenges to DCS's use of the EPRI and LLNL PSHA studies. GANE argues that the studies are seriously out of date and not intended for site-specific use, therefore creating significant flaws in DCS's seismic analysis. Additionally, GANE asserts that the studies need to be updated to take into account important new seismological information that has arisen since the studies were performed.

a. Site-specific Use of the Allegedly Out-of-Date EPRI and LLNL PSHA Studies

GANE first asserts that the EPRI and LLNL PHSA studies are inappropriate for site specific use because they are "seriously out of date,"[159] "conducted in the late 1970s and early 1980s,"[160] and "prepared more than twenty years ago."[161] Next GANE asserts, again relying upon Dr. Long, that the EPRI and LLNL PSHAs were never intended for site-specific use.[162] In this regard, Dr. Long also states that the application of the studies to a specific site was for a

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[159] GANE Disputed Material Facts ¶ 4.

[160] GANE Opposition at 4.

[161] Id. at 2.

[162] See Long Tr. at 175:14-21.

"first guess" before an applicant re-evaluated the site's specific seismicity and attenuation relationships.[163] In this regard, GANE, relying upon certain language in Regulatory Guide 1.165, argues that the NRC Staff guidance "anticipates that license applicants will update their use of the LLNL and EPRI studies with current site-specific information."[164] Accordingly, Dr. Long claims that DCS needs to conduct a new PSHA for the MOX Facility.[165]

In response, DCS states, relying upon the PSHAs themselves, that GANE's claims regarding the age of the EPRI and LLNL studies and data are off by about a decade.[166] DCS argues that the NRC has a longstanding history of using the EPRI and LLNL results in site-specific applications.[167] DCS claims that the NRC specifically allows use of the studies in Regulatory Guide 1.165 that refers to the EPRI and LLNL studies as "an accepted PSHA methodology with a range of credible alternative input interpretations" that "have been reviewed and accepted by the staff."[168] Dr. Stepp, the developer of the methodology for the EPRI PSHA, asserts that he has "first hand knowledge that the EPRI PSHA outputs were expected to be used for specific sites."[169] DCS contends Dr. Stepp's grounds for his assertion are based on his specific involvement with the EPRI PSHA's development while Dr. Long's assertion is that he

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[163] See id. at 175:11-176:1-13.

[164] GANE Opposition at 9.

[165] See Long Tr. at 197:21-22-198:1.

[166] See DCS Reply at 8-9.

[167] See DCS Motion at 26; Stepp Aff. ¶ 39.

[168] See DCS Motion at 26 (quoting NRC Reg. Guide 1.165 at 2-3).

[169] Stepp Aff. ¶ 41.

generally "remember[s] asking someone about [it]" but he "do[es] not remember who or when."[170]

We conclude that GANE's challenge that the EPRI and LLNL PSHAs are outdated and not intended for site specific use raises no genuine issue of material fact to thwart the grant of summary disposition. Seeking to counter DCS's statement that the PSHA studies are appropriate for site specific use,[171] GANE declares in its statement of disputed material facts that the EPRI and LLNL PSHAs are seriously out of date, citing Dr. Long's bare statement that the PSHA analyses were based upon data from the 1970s and early 1980s.[172] GANE's claim, without a great deal more, does not create a material factual dispute for litigation. The PSHA studies speak for themselves[173] and preclude any credible claim, as GANE would have it, that the studies were prepared over twenty years ago.[174] Rather, as DCS states, GANE's dates are in error by about a decade.[175] For example, in NUREG-1488, the 1994 publication comprising part of the LLNL PSHA, the author indicates that in 1992 and 1993 the laboratory used a revised elicitation process to re-elicit input data from the experts on ground motion and seismicity.[176] Further, in the 1993 update to the original 1989 study, the authors note that one of the purposes of the re-elicitation was to "[e]nsure that the experts' knowledge was consistent

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[170] Long Tr. at 176:5-7; see DCS Motion at 25.

[171] See DCS Undisputed Material Facts ¶ 11.

[172] See GANE Disputed Material Facts ¶ 4; Long Aff. ¶ 9(a)(ii).

[173] See supra nn.82, 83.

[174] See GANE Opposition at 2.

[175] See DCS Reply at 9; Stepp Supplemental Aff. ¶ 15.

[176] See P. Sobel, Revised Livermore Hazard Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains, NUREG-1488 (April 1994) at 2.

with the currently available data, theories and information."[177] Indeed, the 1993 update compared, inter alia, the updated hazard estimates with the original estimates for six sites, one of which was the Vogtle nuclear plant site,[178] which is located across the Georgia border from the MOX Facility.[179] Hence, this GANE challenge to the PSHAs presents no genuine issue of material fact.

Similarly, the basis for Dr. Long's claim that the EPRI and LLNL studies were not intended for site-specific use presents no genuine issue of material fact for hearing. Contrary to the requirement of 10 C.F.R. § 2.749(b) that a supported summary disposition motion must be opposed with "specific facts" showing a genuine issue of fact, GANE only relies upon the generalized recollection of Dr. Long to counter DCS's statement of undisputed material facts that the EPRI and LLNL PSHAs are appropriate for site-specific use.[180] At his deposition, Dr. Long remembered asking someone about the use of the studies but he did not remember who or when. Although Dr. Long's affidavit puts a rosier gloss upon it,[181] at bottom his vague recollection is insufficient to demonstrate a genuine and material dispute between the parties.

Nor is GANE's position aided by its argument that the language of Regulatory Guide 1.165 anticipates that the PSHAs will be updated with current site-specific data.[182] As DCS correctly notes, even though the Regulatory Guide deals with power reactors and hence is not

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[177] J.B. Savy et al., Eastern Seismic Hazard Characterization Update, UCRL-ID-115111 (June 1993) at 6.

[178] See id. at 11-17.

[179] See Stepp Supplemental Aff. ¶ 14.

[180] See DCS Undisputed Material Facts ¶ 11.

[181] See Long Aff. ¶ 9(a)(iv).

[182] See GANE Opposition at 9-10.

directly applicable to the MOX Facility, the provisions relied upon by GANE do not mandate the updating of the PSHAs with recent information.[183] Rather, the language relied upon by GANE states only that, when the PSHAs are used, it may be necessary to investigate and to characterize any previously unknown and uncharacterized potential seismic sources.[184] Here, as DCS again notes, GANE has not pointed to any previously unknown or uncharacterized potential seismic sources and the source zones it has identified already are known and characterized.[185]

In an attempt to bolster its argument, GANE also points to the language in the introduction to Appendix E of the Regulatory Guide concerning the evaluation of new information. Again, however, this provision states that new information need be incorporated into the PSHAs only if it would result in a significant increase in the seismic hazard for the site and is validated by a strong technical basis.[186] It should be noted that the section of Appendix E titled "Procedure and Evaluation" also states that "new information is considered not significant and no further evaluation is needed if it is consistent with the assumptions used in the PSHA, no additional alternative seismic sources or seismic parameters are needed, or it supports maintaining or decreasing the site median seismic hazard."[187] Additionally, that section states that "[i]t is expected that the new information will be within the range of interpretations in the existing data base, and the data will not result in an increase in overall seismicity rate or

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[183] See DCS Reply at 15; Stepp Supplemental Aff. ¶ 22.

[184] See Reg. Guide 1.165 at 5 (Section C.2.1).

[185] See DCS Reply at 15.

[186] See Reg. Guide 1.165, Appendix E at E.1.

[187] Id., Appendix E at E.3.

increase in the range of maximum earthquakes to be used in the probabilistic analysis."[188] Thus, even if Regulatory Guide 1.165 were deemed applicable, it does nothing to undercut DCS's assertion that the EPRI and LLNL PSHAs are appropriate for site-specific use.

b. Updating the EPRI and LLNL PSHA Results

GANE next argues that the EPRI and LLNL studies must be updated to account for a plethora of new information.[189] DCS asserts in response that none of the information identified by GANE is new, but rather was either previously considered in the development of the MOX Spectrum or does not support GANE's conclusions.[190] Each argument is examined below.

1. Possibility of a Large Magnitude Earthquake Occurring in the Area of the MOX Facility

GANE contends that the EPRI and LLNL studies did not adequately consider a paper authored in 2002 by Dr. Alan Kafka.[191] The paper, GANE contends, suggests that there is a 30 percent chance that a magnitude 7.0 plus earthquake could occur virtually anywhere in South

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[188] Id.

[189] See GANE Opposition at 7-8; GANE Staff Response at 6.

[190] See DCS Motion at 29.

[191] See Second GANE Supplemental Interrogatory Response 3.7; A. L. Kafka, 73, Statistical Analysis of the Hypothesis that Seismicity Delineates Areas Where Future Large Earthquakes Are Likely to Occur in the Central and Eastern United States, Seismological Research Letters, 992-1003 (Nov./Dec. 2001) [hereinafter Kafka].

Even though GANE did not see fit to include the Kafka paper as an exhibit to its opposition to DCS's motion for summary disposition, we nevertheless were able to unearth a copy.

Carolina.[192] In other words, Dr. Long's claim posits the possibility of a large,[193] "floating" (i.e. randomly located) earthquake.

The Kafka study is a statistical analysis of spatial distributions of small earthquakes.[194] Kafka tested his theory analyzing micro and small earthquakes for the Southeastern United States. For this area, which encompasses, inter alia, the MOX Facility, Kafka considered small earthquakes, between magnitude 2.0 and 3.0, for the period 1924 to1987, and large earthquakes, between magnitude 3.0 and 4.8, for the period between 1988 and 2001.[195] Kafka concluded that 60 percent of the "large" earthquakes (i.e., between magnitude 3.0 and 4.8) in the Southeastern United States had epicenters located within 30 kilometers of where small earthquakes occurred.[196]

It is the comparison between the small and larger earthquakes, DCS argues, that led GANE to conclude that Kafka's analysis shows a 30 percent or greater chance that a magnitude 7.0 plus earthquake could appear anywhere.[197] DCS states that the EPRI and LLNL PSHAs did take into account the possibility of a major earthquake.[198] Thus, DCS asserts, GANE's reliance upon Kafka's theory does not present any new information.[199] Indeed, DCS

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[192] See Second GANE Supplemental Interrogatory Response 3.7.

[193] Kafka, for purposes of his study, considered a "large" earthquake as one with a magnitude between 3.0 and 4.8.

[194] See Kafka at 992-1003.

[195] See id. at 993 and Fig. 1.

[196] See id. at Table 1.

[197] See DCS Motion at 31-32.

[198] See id. at 30.

[199] See id.

states that Dr. Long admitted in his deposition that a large earthquake was considered by at least one expert in the EPRI and LLNL PSHAs.[200] DCS further states that NRC guidelines allow the use of the EPRI and LLNL studies without re-weighing epicenters because both PSHAs are NRC-accepted methodologies for site-specific use.[201]

Further, DCS argues, Kafka's paper did not consider any earthquake above a magnitude 4.8 in the Southeastern United States, and therefore is not relevant to the MOX Facility's seismic design.[202] It claims that Kafka's work has no demonstrated applicability to a major earthquake on the South Carolina Coastal Plain[203] and that his data set considered smaller earthquakes only after 1924, thus excluding the 1886 Charleston earthquakes and all the paleoearthquakes associated with the Charleston Seismic Zone.[204] The paper also ignored, as Dr. Long admits,[205] all known geologic/liquefaction features associated with the South Carolina Coastal Plane,[206] which reveal earthquake occurrences over the past 6000 years. Based on this analysis, DCS argues, none of the earthquakes used by Kafka is of a magnitude to be of concern for the seismic design of the MOX Facility.[207] Dr. Stepp concludes that he believes Kafka's results cannot be reasonably extrapolated to predict the expected location of

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[200] See id.; see also Long Tr. at 360:7-16; 15:19-22.

[201] See DCS Motion at 25-28; Stepp Supplemental Aff. ¶ 21.

[202] See DCS Motion at 31.

[203] See id. at 32; Stepp Aff. ¶ 44.

[204] See DCS Motion at 32; Stepp Aff. ¶ 45.

[205] See Long Tr. at 364:8-11.

[206] See DCS Motion at 32-33.

[207] See Stepp Aff. ¶ 45.

"truly large and major earthquakes."[208] According to Dr. Stepp, Kafka's use of relatively small earthquakes that could occur anywhere are of no importance to the seismic design of the MOX Facility.[209] Rather, he asserts that the earthquakes that should be considered for the MOX Facility are magnitude 5.0 or higher, and these earthquakes were incorporated into the EPRI PSHA.[210]

The Staff agrees with DCS. Its expert, Dr. Stamatakos, states that Kafka's paper was about small earthquakes.[211] Dr. Stamatakos asserts that Dr. Long has provided no support to justify extrapolating data from small earthquakes as a forecast for large ones.[212]

In his paper, Kafka concludes from his comparison of small and large earthquakes between magnitude 3.0 and 4.8, that, at the 95 percent level of statistical confidence, it can be inferred that more than 71 percent of large earthquakes in a region will tend to occur near previous small earthquakes.[213] This statement apparently is the basis for GANE's belief that Kafka's paper supports the idea that 30 percent of the large earthquakes in the Central and Eastern United States can occur anywhere. As both DCS and the Staff note, Dr. Long fails to explain how, or why, he extrapolates Kafka's examination of the spatial variability of small earthquakes to include earthquakes of very large magnitude. In order for an expert's opinion to be admissible, the expert's opinion must be based on the "methods and procedures of science"

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[208] Id. ¶ 46.

[209] See id. ¶ 45.

[210] See id. ¶ 46.

[211] See Stamatakos Aff. ¶¶ 16-18.

[212] See id.

[213] See Kafka at 1001.

rather than on "subjective belief or unsupported speculation."[214] Further, an expert's opinion must be based on sufficient facts or data, to be the product of reliable principle and methods which the witness applied to the facts of the case.[215] Because Dr. Long fails to provide any link between Kafka's analysis of a select data set of smaller earthquakes and his conclusion that Kafka's analysis is applicable to very large, floating earthquakes occurring near the MOX Facility, his opinion fails to meet the standards set forth in Daubert and Rule 702 of the Federal Rules of Evidence. Accordingly, in these circumstances his opinion does not raise a genuine issue of material fact in need of resolution by further informal hearing procedures.

2. Consideration of a 7.5 Magnitude Earthquake in the Eastern Tennessee Seismic Zone

Relying on Dr. Long's opinion, GANE argues that the EPRI and LLNL studies did not adequately and quantitatively consider that a magnitude 7.5 earthquake could occur in the Eastern Tennessee Seismic Zone.[216] GANE asserts "[i]n particular, a New Madrid type Event (Magnitude 7.5) should be considered for southeastern Tennessee for evaluation of potential effects on the Savannah River Site."[217] GANE contends that if this new information were taken into account, it would likely lead to an increase in the ground motions for the MOX Facility's seismic hazard spectra.[218]

DCS contends that it is undisputed that the EPRI and LLNL PSHA studies included the possibility of a 7.5 earthquake in southeastern Tennessee, with at least one interpretation in

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[214] Daubert, 509 U.S. at 589-90.

[215] See Fed. R. Evid. 702.

[216] See GANE Opposition at 11-12; Long Aff. ¶ 37.

[217] Second GANE Interrogatory Response 3.45(a).

[218] See id. 3.45(c).

both studies placing a 7.5 earthquake in the Eastern Tennessee Seismic Zone.[219] Additionally, DCS asserts that it is not generally accepted that a 7.5 magnitude earthquake could occur in this zone.[220] Southeast Tennessee frequently has small earthquakes, but none have been above a moment magnitude greater than about 5.0.[221] According to Dr. Stepp, the geophysical structure underlying the Eastern Tennessee Seismic Zone is unlikely to support magnitude 7.0 plus earthquakes[222] and Dr. Stepp's opinion, DCS claims, is consistent with the views generally accepted in the scientific community regarding this seismic zone.[223] Further, DCS notes that Dr. Long himself admits that he is "a bit of an outlier" in his opinion.[224] The NRC Staff argues that Dr. Long has provided no basis for his opinion that such an earthquake would occur.[225]

In expressing his opinion that a large, 7.0 plus magnitude earthquake could occur in the Eastern Tennessee Seismic Zone and hence should be taken into account for the MOX Facility's seismic hazard spectra, Dr. Long fails to provide a factual foundation for his assertion that such an earthquake could occur. To oppose a motion for summary disposition, mere bare assertions, even assertions by an expert, without a fully explained factual basis are insufficient

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[219] See DCS Undisputed Material Facts ¶ 22; DCS Motion at 33-34; Stepp Aff. ¶ 48.

[220] See DCS Undisputed Material Facts ¶¶ 23-24; DCS Motion at 34.

[221] DCS Undisputed Material Facts ¶ 23; Stepp Aff. ¶ 49.

[222] See Stepp Aff. ¶ 50.

[223] See DCS Undisputed Material Facts ¶ 24; DCS Motion at 35; Stepp Aff. ¶ 50.

[224] See DCS Motion at 34; Long Tr. at 159:1-5.

[225] See Staff Response at 10; Stamatakos Aff. ¶¶ 19-20.

to create a genuine and material factual dispute.[226] Accordingly, Dr. Long's unsupported opinion is insufficient to defend against a motion for summary disposition.

3. Consideration of Additional Epicenters for Charleston-type Earthquakes

GANE claims that DCS did not take into account recent paleoseismic work on the South Carolina Coastal Plain that it asserts shows more seismic activity in the last 6000 years and over a wider area than previously known.[227] GANE states that two other locations in South Carolina, Bluffton and Georgetown, also were epicenters for Charleston-like earthquakes occurring over the past 6000 years, and that DCS did not consider this new information in its seismic analysis. For support, GANE relies on the opinion of Dr. Long and an article published in 2001 by P. Talwani and W. Schaeffer discussing paleoliquefaction along the South Carolina Coastal Plain.[228]

DCS argues that the work of Talwani and Schaeffer discusses recurrence rates of large earthquakes on the South Carolina Coastal Plain, not their location.[229] In relation to the recurrence rates, the authors also discuss two scenarios to explain the location of paleoliquefaction data.[230] In one scenario, Talwani and Schaeffer place the epicenters of all

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[226] See Advanced Med. Sys., Inc., CLI-93-22, 38 NRC at 102; Houston Lighting and Power Co., ALAB-629, 13 NRC at 78; Virginia Elec. Power Co. (North Anna Nuclear Power Station, Units 1 and 2), ALAB-584, 11 NRC 451, 453, 455 (1980); Yankee Atomic Elec. Co., LBP-96-18, 44 NRC at 103.

[227] See Revised GANE Contention 3 at 1.

[228] See P. Talwani & W. Schaeffer, Recurrence rates of large earthquakes in the South Carolina Coastal Plain based on paleoliquefaction data, 106, No. B4, Journal of Geophysical Research, 6621-42 (Apr. 10, 2001) [hereinafter Talwani & Schaeffer].

[229] See DCS motion at 36 (citing Talwani & Schaeffer at 6621-42).

[230] See id. at 36-37 (citing Talwani & Schaeffer at 6621).

earthquakes near Charleston, South Carolina.[231] In the other scenario they place the epicenters in South Carolina near Bluffton, Georgetown, and Charleston.[232] In the first sentence of the article abstract, Talwani and Schaeffer state that they "present a reanalysis of results of 15 years of paleoliquefaction investigations in the South Carolina Coastal Plain."[233] DCS notes, therefore, that the two scenarios discussed in the article are not new.[234]

Further, DCS asserts that the two scenarios Talwani and Schaeffer explore were raised a decade earlier in an NRC document that Talwani and Schaeffer cite.[235] It explains that in 1990 the authors of NUREG/CR-5613 examined and identified several liquefaction features in the same areas as the Bluffton and Georgetown locations identified by Talwani and Schaeffer.[236] According to DCS, that document offers an explanation for the presence of liquefaction features located in those areas, including that the earthquake epicenters could have been outside of Charleston.[237] Further, DCS notes that Dr. Long concedes that Talwani and Schaeffer's opinions are not new.[238]

DCS also asserts that the earthquake epicenters located along coastal South Carolina, but outside of Charleston, provided by Talwani and Schaeffer and NUREG/CR-5613, were

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[231] See id. at 37 (citing Talwani & Schaeffer at 6641).

[232] See id. (citing Talwani & Schaeffer at 6621).

[233] See id.

[234] See DCS Motion at 37.

[235] See id. (citing Talwani & Schaeffer at 6641).

[236] See id. (citing D. Amick et al, Paleoliquefaction features Along the Atlantic Seaboard, NUREG/CR-5613 at 77, Fig. 10.2 (1990) [hereinafter NUREG/CR-5613]).

[237] See id. at 37-38 (citing NUREG/CR-5613 at 98, 117).

[238] See id. at 38; Long Tr. at 257:15-20.

considered in the seismic design of the MOX Facility.[239] Additionally, the EPRI and LLNL studies included alternative evaluations that major earthquakes could occur practically anywhere along the eastern United States.[240] DCS concludes, therefore, that Talwani and Schaeffer did not present any new information regarding locations of earthquakes in coastal South Carolina that DCS needs to consider.[241] DCS argues, however, that even if the information was deemed new, GANE has not shown that the consideration of these new locations would increase the predicted ground motion of the design earthquake for the MOX Facility.[242] Finally, DCS notes that even Dr. Long admits that "it may or may not change any of the results,"[243] and that he had "conducted no independent analyses to suggest the seismic hazard would increase."[244]

For its part, the Staff states that the Talwani and Schaeffer scenarios were considered in NUREG/CR-5613, which in turn, were considered in the seismic design of the MOX Facility.[245] Moreover, the Staff notes, neither Bluffton nor Georgetown is any closer to the SRS than the 120 kilometer distance DCS used as the modeled historical check.[246] Thus, GANE's claim, even if accurate, lacks materiality.[247]

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[239] See DCS Motion at 38.

[240] See id.; Long Tr. at 256:10-18.

[241] See DCS Motion at 39.

[242] See id.

[243] See id.; Long Tr. at 272:19-273:1, 316:7-13.

[244] See DCS Motion at 39; Long Tr. at 45:7-11.

[245] See Staff Response at 11.

[246] See id.

[247] See id.

We conclude that GANE's claim does not preclude summary disposition for several reasons. First, DCS has clearly established that the scenarios detailed in Talwani and Schaeffer were considered previously, and thus are not new material that needs to be considered. Second, the information set out in Talwani and Schaeffer was included in NUREG/CR-5613, which was considered in the EPRI and LLNL PSHA studies. Third, as the Staff correctly notes, neither Bluffton nor Georgetown is any closer to the SRS than the 120 kilometer distance used by DCS for the modeled historic check, so GANE's claim fails to present a genuine issue of material fact. It is not enough that the non-moving party merely allege an issue of fact; rather, the issue of fact must be material. In order to be material, the fact must be able to affect the outcome of the case. Here, GANE's claim, even if accepted, would have no affect on the outcome of the case, and thus it fails to create a genuine issue of fact that must be resolved.

4. Shorter Recurrence Intervals of Charleston-type Earthquakes

GANE also relies on Talwani and Schaeffer to support its argument that the recurrence interval for characteristic Charleston earthquakes along coastal South Carolina is much shorter than previously considered in the EPRI and LLNL studies.[248] GANE notes that one scenario that Talwani and Schaeffer present calls for a magnitude 7.0 plus Charleston earthquake occurring in the last 6000 years with a recurrence interval of 600 years.[249]

DCS argues that the hypothesis of a 600 year interval is not new. The 600 year return interval was discussed in NUREG/CR-5613, published more than a decade before Talwani and Schaeffer, which was in turn included in the seismic design of the MOX Facility.[250] DCS claims

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[248] See GANE Contention 3 at 14.

[249] See id. (citing Talwani & Schaeffer at 6641).

[250] See DCS Motion at 40.

that because information GANE refers to is not new, it fails to justify GANE's call for the need to update the EPRI and LLNL PSHAs.[251]

GANE responds by arguing that DCS does not explain to what extent the EPRI and LLNL PSHA studies took into account the 600 year return interval mentioned by Talwani and Schaeffer and NUREG/CR-5613.[252] GANE claims that it was not enough that the information was "considered." Dr. Long attacks the EPRI and LLNL PSHAs by asserting that they are outdated and if re-examined today, they possibly would result in a higher seismic hazard at the Savannah River Site.[253]

DCS counters first by noting that GANE does not deny that the information is not new,[254] and then by asserting that the EPRI and LLNL PSHAs only need to be re-evaluated if new models or data suggest a major departure in the PSHA results.[255] As Dr. Stepp explains, the EPRI and LLNL PSHA studies, conducted a decade later than Dr. Long asserts, were designed to include uncertainties to account for both incomplete data and evolving knowledge.[256] Dr. Stepp asserts that it is fundamental to the performance of a PSHA that its developers estimate annual non-exceedance frequencies of ground motions with some degree of uncertainty.[257] Accordingly, an objective of both PSHAs was to obtain a robust quantification of this uncertainty

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[251] See id. at 28-29.

[252] See GANE Opposition at 11-12; Long Aff. ¶ 41.

[253] See Long Aff. ¶ 9(a).

[254] See DCS Reply at 18.

[255] See Stepp Supplemental Aff. ¶ 20.

[256] See id. ¶¶ 15, 17.

[257] See id. ¶ 18.

for power plant sites in the central and eastern United States.[258] Experts' varying interpretations of data are accounted for in the final quantitative determinations in the PSHAs resulting in a robust set of PSHA results expected to withstand the test of time, new data, models, or interpretations.[259] Dr. Stepp concludes the studies have proven so robust that re-evaluation has been unnecessary.[260]

Because the PSHAs considered the shorter recurrence interval of 600 years, we conclude that GANE fails to raise "new" information that must be considered. In addition, GANE's analysis that the studies need to be recomputed to account for the new information lacks merit because, as Dr. Stepp has clearly explained, the EPRI and LLNL studies encompass various interpretations of data that existed at the time the studies were done, such as NUREG/CR-5613, and are robust enough in design to encompass any new data that may be received for years to come, absent any new data or models suggesting a major departure in PSHA results.[261] Therefore, GANE's assertion regarding the extent to which the 600 year recurrence interval was considered in the EPRI and LLNL PSHAs is quantitatively irrelevant and hence immaterial. Dr. Long has provided no analysis demonstrating or explaining why consideration of the 600 year recurrence interval would result in a higher seismic hazard at the Savannah River Site than the recurrence interval projected using the EPRI and LLNL PSHAs. In light of this, and Dr. Stepp's explanation of the uncertainty inherent in a PSHA, GANE has failed to present a genuine issue of material fact needing resolution by informal hearing procedures.

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[258] See id.

[259] See id. ¶ 19.

[260] See id. ¶ 20.

[261] See id.

5. Increased Magnitude of Historical Earthquake on the South Carolina Coastal Plain

GANE argues that magnitudes of historical earthquakes in the South Carolina Coastal Plain may have been much greater than previously considered by the EPRI and LLNL studies. To support this claim, GANE relies on the opinion of Dr. Long, who, in turn, relies on two articles discussing a recent study of paleoliquefaction data on the South Carolina Coastal Plain authored by Ke Hu, Sarah Gassman, and Pradeep Talwani.[262]

DCS claims, however, that these studies are no longer valid. In that regard, Dr. Stepp asserts that the studies are flawed "because they did not consider how aging affects soil strength."[263] The conclusions in the first article, of which Ke Hu is the primary author, are in error Dr. Stepp argues, because the authors, by their own admission, did not correct the soil strength to account for aging.[264] According to Dr. Stepp, this is "significant because old soil deposits are more resistant to liquefaction than younger deposits."[265] Consequently, DCS states that the estimates of earthquake magnitudes drawn from liquefaction features made in the second article, of which Ke Hu is also the primary author, would have to be lowered to correct for soil aging.[266] Further, DCS claims that GANE's expert, Dr. Long, cannot dispute these findings because Dr. Long, by his own admission, is not an expert in how soil affects the

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[262] See Second GANE Supplemental Interrogatory Response, General Interrogatory 3; see also Ke Hu, Sarah L. Gassman, and Pradeep Talwani, Magnitudes of Prehistoric Earthquakes in the South Carolina Coastal Plain from Geotechnical Data, 73 No. 6, Seismological Research Letters, 979-91 (2002); Ke Hu, Sarah L. Gassman, and Pradeep Talwani, 73 No. 6, In-situ Properties of Soils at Paleoliquefaction Sites in the South Carolina Coastal Plain, Seismological Research Letter, 964-78 (2002).

[263] See Stepp Aff. ¶ 61.

[264] See id.; DCS Motion at 43.

[265] DCS Motion at 42.

[266] See id.

magnitude of an earthquake and thus cannot proffer an expert opinion on this matter.[267] Further, DCS asserts that Dr. Long provides no independent analysis to support or rehabilitate the discredited article.[268]

Dr. Stepp seriously undermines the credibility of the Hu papers. While GANE does not agree with DCS's characterization of the articles, it fails directly to rebut DCS's claim that the articles do not account for the soil age and its effect on magnitude. In order to create a genuine issue of material fact, GANE must directly refute DCS's technical criticism of the paper set forth in ¶¶ 39 and 40 of DCS's Undisputed Material Facts. Dr. Long is unable to rehabilitate the article because he is not an expert in soil properties. Similarly, he provides no independent analysis to support the paper. Thus, the only evidence proffered to present a genuine issue of material fact has been discredited. Dr. Long acknowledges that he is not an expert in how soil properties affect earthquake magnitudes. Had GANE produced an expert in the geotechnical properties of soil who could affirm the earthquake magnitude estimates in the articles that GANE relies upon are still valid, then this would generate a genuine issue of material fact; but, with no evidence to show that the estimates in the papers are still technically valid, GANE fails to generate a genuine issue of material fact.

6. Consideration of New Ground Motion Attenuation Models

GANE contends that the EPRI and LLNL studies did not adequately consider recent attenuation models that more accurately model post-critical reflection – also known as the Moho Bounce. GANE states that, while it generally agrees with DCS's approach in computing the

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[267] See id. at 43; Long Tr. at 278:21, 280:19-22.

[268] See DCS Motion at 43.

PSHA,[269] DCS's reliance fell short when it did not take into account recent studies providing more detailed and site-specific information. Because of this failure, GANE claims DCS has "underestimated the amplitude of the design basis earthquake at the Savannah River Site."[270] GANE further contends that the EPRI and LLNL PSHAs "did not appropriately model the attenuation of earthquake amplitude over a distance of appropriately 110 kilometers . . . because they assumed uniform decay of amplitude over that distance."[271] Dr. Long identified one ground motion attenuation model that DCS should have considered: Atkinson and Boore.[272] Dr. Long claims that if Atkinson and Boore had been used, it would increase the amplitude at the MOX Facility from a factor of two to four.[273]

In response, DCS first notes that GANE relies solely on the bare assertion of Dr. Long, who provided no data or analysis to support his assertion that if DCS had considered Atkinson and Boore it would have altered the amplitude at the MOX facility.[274] Further, the EPRI and LLNL studies include assessments of uncertainty in ground motion attenuation that adequately consider Atkinson and Boore.[275] DCS cites several attenuation models that have been published since Atkinson and Boore, and notes that it appears that GANE favors Atkinson and Boore because it presents a model that exhibits pronounced non-uniform decay to account for

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[269] See Third GANE Supplemental Interrogatory Response 3.30; Long Tr. at 135:8-22-136:1-13.

[270] See Second GANE Supplemental Interrogatory Response, General Interrogatory 3.

[271] See Third GANE Supplemental Interrogatory Response 3.6.

[272] See Atkinson, G.M. and Boore, D.M., Ground-Motion Relations for Eastern North America, BSSA, Vol. 85, No. 1, pp. 17-30 (Feb. 1995).

[273] Long Tr. at 46:20-22-47:1-4.

[274] See DCS Reply at 20.

[275] See DCS Motion at 45.

the Moho Bounce.[276] DCS asserts that it is unclear why consideration of Atkinson and Boore would materially affect the seismic design of the MOX facility.[277] First, the consideration of the Moho Bounce in a PSHA is different than its consideration for a "historical check."[278] The PSHA weighs multiple earthquakes at multiple distances and azimuths with respect to a particular location.[279] Many of these locations, DCS notes, are not within the distance range in which the Moho Bounce would occur.[280] Consequently the Moho Bounce, and thus Atkinson and Boore, would not be applicable for these potential earthquake locations.[281]

DCS argues that, even if GANE could somehow show how Atkinson and Boore applied to the MOX Facility, that application would be irrelevant because the EPRI and LLNL PSHAs envelope the Atkinson and Boore model.[282] Dr. Stepp states that the EPRI and LLNL PSHAs encompass a large range of uncertainty and the Atkinson and Boore model falls within the range of uncertainties.[283] For a moment magnitude 7.0 earthquake at a distance of 100 kilometers, the Atkinson and Boore model produces results in accelerations and frequencies similar to the other attenuation models used in the EPRI and LLNL PSHAs.[284]

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[276] See id.; Stepp Aff. ¶¶ 66-67; Long Tr. at 424:15-425:6.

[277] See DCS Motion at 45; Stepp Aff. ¶ 69.

[278] See DCS Motion at 45; Stepp Aff. ¶ 69.

[279] See DCS Motion at 45; Stepp Aff. ¶ 69.

[280] See DCS Motion at 46; Stepp Aff. ¶ 69.

[281] See DCS Motion at 46.

[282] See DCS Motion at 46; Stepp Aff. ¶ 71.

[283] See Stepp Aff. ¶ 71.

[284] See id.

Because consideration of the attenuation models that incorporate the possible effects of a Moho Bounce would not materially affect the seismic design of the proposed MOX Facility, we conclude that this issue fails to generate a genuine issue of material fact. In his analysis, Dr. Stepp compared the Atkinson and Boore model to the models used in the EPRI and LLNL PSHAs and found that the Atkinson and Boore model did not vary from the other attenuation models. Dr. Long provides no analysis to counter Dr. Stepp's opinion. Bare assertions and general denials are insufficient to defeat a well supported motion for summary disposition. Similarly, the mere citation to the published work of another will not defend against summary disposition. Hence, GANE's arguments fail to generate a genuine issue of material fact with respect to the Moho Bounce.[285]

VII. Conclusion

GANE fails to present a genuine issue of material fact with respect to Contention 3. After thoroughly examining its arguments concerning the adequacy of the historical check, computation of the effective PGA to determine the horizontal ground surface spectrum, and various arguments against the site-specific use of the EPRI and LLNL PSHAs, we find that GANE has failed to raise a genuine issue of material fact to defend against DCS's motion for

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[285] See 10 C.F.R. § 2.749(b); see also Houston Lighting and Power Co., ALAB-629, 13 NRC at 78; Rohrbough by Rohrbough v. Wyeth Lab., Inc., 719 F. Supp. at 475.

summary disposition. Consequently, DCS's summary disposition motion of Contention 3 is granted.

It is so ORDERED.

THE ATOMIC SAFETY
AND LICENSING BOARD[286]

/RA/

Thomas S. Moore, Chairman
ADMINISTRATIVE JUDGE

/RA/

Dr. Charles N. Kelber
ADMINISTRATIVE JUDGE

/RA/

Dr. Peter S. Lam
ADMINISTRATIVE JUDGE

Rockville, Maryland
February 2, 2005

[286] Copies of this Order were sent this date by Internet e-mail transmission to (1) GANE; (2) BREDL; (3) DCS; and (4) the NRC Staff.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
DUKE COGEMA STONE & WEBSTER	)	Docket No. 70-3098-ML
	)	
(Savannah River Mixed Oxide Fuel	)	
Fabrication Facility)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing LB MEMORANDUM AND ORDER (GRANTING APPLICANT'S MOTION FOR SUMMARY DISPOSITION ON CONTENTION 3) (LBP-05-04) have been served upon the following persons by U.S. mail, first class, or through NRC internal distribution.

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Docket No. 70-3098-ML
LB MEMORANDUM AND ORDER (GRANTING
APPLICANT'S MOTION FOR SUMMARY
DISPOSITION ON CONTENTION 3) (LBP-05-04)

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Office of the Secretary of the Commission

Dated at Rockville, Maryland,
this 3rd day of February 2005