IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW MEXICO

STATE OF NEW MEXICO, *et al.*,	)		
	)		
Plaintiffs,	)	Case Nos.	CIV 99-1118 BSJ/KBM
	)		CIV 99-1254 BSJ/ACT
vs.	)		(Consolidated)
	)		
GENERAL ELECTRIC COMPANY, *et al.*,	)		
	)		
Defendants.	)		

FINDINGS & ORDER RE: EXPERT WITNESSES

For some time, court and counsel have been engaged in an extended Pre-Trial Conference in this case, attempting to identify and define those genuine issues of fact that need to be resolved through trial. (*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), *passim*.) At the August 6-8, 2003 Pretrial Conference, the court heard, considered and granted defendant General Electric Company's motion for an evidentiary hearing concerning certain expert witnesses under Fed. R. Evid. 702,[1] setting that hearing to commence on December 9, 2003. (*See* Minute Entry, dated August 6-8, 2003 (dkt. no. 1014), at 5-6, 7-8; Order, filed September 2, 2003 (dkt. no. 1015), at 3.)

From December 9 through December 12, 2003, and continuing through January 7 and 8, 2004, the court heard testimony from Dennis E. Williams, David S. Brookshire, Stephen B. Johnson, Steven P. Larson, Gerald E. Grisak, Matthew Davis, Emlen Hall, John A. Connor, John Billiard, Phillip Soice, Dennis Cooper, Theodore Tomasi, Donald E. Myers, John W. Hawley, and William H. DesVousges. The court also heard argument by counsel concerning these experts and Plaintiffs' damages theories. The court took those matters under advisement. (*See* Minute Entry, dated December 9-12, 2003 (dkt. no. 1059); Minute Entry, dated January 7-8, 2004 (dkt. no. 1066).)

The court has heard, reviewed and considered the proffered expert testimony in

[1](General Electric Company's Motion for Evidentiary Hearing in Light of Recent Tenth Circuit Authority, filed July 1, 2003 (dkt. no. 1000).)

light of the requirements of Fed. R. Evid. 702,[2] as construed in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999), and more recently, *Dodge v. Cotter Corp.*, 328 F.3d 1212, 1221-29 (10th Cir.), *cert. denied*, 124 S.Ct. 533 (2003), as well as considerations of relevance and admissibility under Fed. R. Evid. 401, 402 and 403.

I. EXPERT WITNESSES & FED. R. EVID. 702

A. Rule 702, Gatekeeping and the Two R's: Reliability and Relevance

"It is by now well established that Fed. R. Evid. 702 imposes on a district court a gatekeeper obligation to 'ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable.'" *Dodge v. Cotter Corp.*, 328 F.3d 1212, 1221 (10th Cir. 2003) (quoting *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 589 (1993)).

> This gatekeeper function requires the judge to assess the reasoning and methodology underlying the expert's opinion, and determine whether it is both scientifically valid and applicable to a particular set of facts. . . . The Supreme Court has made clear that "where [expert] testimony's factual basis, data, principles, methods, or their application are called sufficiently into question . . . the trial judge must determine whether the testimony has 'a reliable basis in the knowledge and experience of [the relevant] discipline.'"

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[2]Federal Rule of Evidence 702, which governs the use of expert testimony in federal courts, reads:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

Id. at 1221-22 (citations omitted) (quoting *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 149 (1999) (quoting *Daubert*, 509 U.S. at 592)). *Accord United States v. Velarde*, 214 F.3d 1204, 1208 (10th Cir. 2000).

Daubert lists four "non-exclusive" factors that bear upon Rule 702 reliability of scientific testimony: (1) whether the opinion at issue is susceptible to testing and has been subjected to such testing; (2) whether the opinion has been subjected to peer review; (3) whether there is a known or potential rate of error associated with the methodology used and whether there are standards controlling the technique's operation; and (4) whether the theory has been accepted in the scientific community. *Daubert*, 509 U.S. at 593-94.

> [T]he list is not exclusive, and district courts applying *Daubert* have broad discretion to consider a variety of other factors. *Kumho Tire,* 526 U.S. at 150, 119 S.Ct. 1167 ("[W]e can neither rule out, nor rule in, for all cases and for all time the applicability of the factors mentioned in *Daubert* . . . . Too much depends upon the particular circumstances of the particular case at issue.").

Dodge v. Cotter Corp., 328 F.3d at 1222.

The party proffering an expert's testimony "need not prove that the expert is undisputably correct or that the expert's theory is 'generally accepted' in the scientific community." *Mitchell v. Gencorp Inc.,* 165 F.3d 778, 781 (10th Cir. 1999). Instead, the proffering party "must show that the method employed by the expert in reaching the conclusion is scientifically sound and that the opinion is based on facts which satisfy Rule 702's reliability requirements." *Dodge v. Cotter*, 328 F.3d at 1222 (citing *Mitchell*, 165 F.3d at 781). Under *Daubert,* "any step that renders the analysis unreliable . . . renders

the expert's testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology." *Mitchell,* 165 F.3d at 782 (quoting *In re Paoli R.R. Yard PCB Litigation,* 35 F.3d 717, 745 (3d Cir. 1994)). Where scientific expertise is asserted "It is critical that the district court determine 'whether the evidence is genuinely scientific, as distinct from being unscientific speculation offered by a genuine scientist.' *Id.* at 783 (quoting *Rosen v. Ciba-Geigy Corp.,* 78 F.3d 316, 318 (7th Cir. 1996))." *Dodge v. Cotter Corp.*, 328 F.3d at 1222.

Not limited to scientific subjects, the gatekeeping requirement extends to all expert opinion testimony, and as gatekeeper, a district court should "make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field." *Kumho Tire*, 526 U.S. at 152. As this court has often observed, the witness may be an expert, and the witness may have an opinion, but it may not be an expert opinion.

In addition to reliability, Rule 702 further requires that the evidence or testimony "assist the trier of fact to understand the evidence or to determine a fact in issue." According to *Daubert,*

> This condition goes primarily to relevance. "Expert testimony which does not relate to any issue in the case is not relevant and, ergo, non-helpful." 3 Weinstein & Berger ¶¶ 702[02], p. 702- 18. See also *United States v. Downing,* 753 F.2d 1224, 1242 (CA3 1985) ("An additional consideration under Rule 702--and another aspect of relevancy--is whether expert testimony proffered in the case is sufficiently tied to the facts of the case

> that it will aid the jury in resolving a factual dispute"). The consideration has been aptly described by Judge Becker as one of "fit." *Ibid.* "Fit" is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes.

509 U.S. at 591.

Under Rule 702, then, a district court must determine whether (1) the proposed witness is a qualified expert in the area in which he or she is being offered as an expert; (2) the proposed expert's testimony is reliable and (3) the expert's testimony will assist the trier of fact because it fits relevant issues in the case. *See In re Paoli Railroad Yard PCB Litigation*, 35 F.3d 717, 741-43 (3d Cir. 1994) (citing *Daubert*, 509 U.S. at 595). The proffering party must establish the expert's qualifications and the reliability and fit of the proposed testimony by a "preponderance of proof." *In re TMI Litigation*, 193 F.3d 613, 663 (3d Cir. 1999).

B. Reliability: Specific Findings Required

"A natural requirement of the gatekeeper function is the creation of a 'sufficiently developed record in order to allow a determination of whether the district court properly applied the relevant law." *Dodge v. Cotter Corp.*, 328 F.3d at 1223 (quoting *Goebel v. Denver & Rio Grande W. R.R. Co.*, 215 F.3d 1083, 1087 (10th Cir. 2000)).

> In *Velarde*, we observed that "*Kumho* and *Daubert* make it clear that the [district] court must, on the record make *some* kind of reliability determination." Thus, we held in *Goebel* that when faced with a party's objection, a district court "must adequately demonstrate by *specific findings on the record* that it has performed its duty as gatekeeper." 215 F.3d at 1088 (emphasis added). "Without specific findings or discussion on the record, it is impossible on appeal to determine whether the district court

> carefully and meticulously reviewed the proffered scientific evidence or simply made an off-the-cuff decision to admit the expert testimony." *Id.* (quotations omitted).

Id. (emphasis in original).

Moreover, under Rule 702, the court must "determine reliability in light of the particular facts and circumstances of the particular case," *Kumho Tire*, 526 U.S. at 158, recognizing the quintessential importance of *context* to the question of whether an expert's opinions may be helpful to the trier of fact.

C. Expert Opinions & the Ultimate Issue of Injury

Expert witnesses may offer an opinion on an ultimate issue, Fed. R. Evid. 704(a),[3] but to be helpful to the trier of fact, that opinion must necessarily take into account the material facts that bear upon the ultimate issue and must explicitly explore its underlying criteria. *See, e.g., United States v. Simpson*, 7 F.3d 186, 188-89 (10th Cir. 1993) (upholding exclusion under Rule 704 when the "expert merely states an opinion on an ultimate issue without adequately exploring the criteria upon which the opinion is based," so that "the jury is provided with no independent means by which it can reach its own conclusion or give proper weight to the expert testimony"). An opinion on an ultimate issue that omits or ignores material facts bearing upon the ultimate issue cannot be helpful to the trier of fact. *Cf. Kieffer v. Weston Land, Inc.*, 90 F.3d 1496, 1499 (10th Cir. 1996) (expert witness "acknowledged he was unable to formulate an opinion on the ultimate

[3]"[T]estimony in the form of an opinion or inference otherwise admissible is not objectionable because it embraces an ultimate issue to be decided by the trier of fact." Fed. R. Evid. 704(a).

issue in dispute," whether wiring of a vending machine was defective, because of a missing machine part).

The question of injury to the State's interests in South Valley groundwater is an ultimate issue.

Establishing an injury to the State's interest in making groundwater available for appropriation requires proof of a *net* reduction in the *total* volume of water that may be extracted from the Middle Rio Grande Basin aquifer as determined by the State Engineer, either to satisfy existing water rights or new applications. This reduction may take the form of an impairment of the exercise of existing water rights, or may be reflected in a reduction in the volume of unappropriated water otherwise available for use.

Plaintiffs addressed "injury" in terms of two groundwater services: (1) extractive use as "a drinking water source"; and (2) *in situ* service as "a 'drought reserve,'" asserting that the State's interests in groundwater have been injured by the permanent loss of both.[4] Consistent with this approach, Plaintiffs' expert, Dr. Dennis E. Williams, performed analysis and formulated opinions concerning both services, first by estimating the volume of the plume of contaminated *in situ* groundwater in excess of New Mexico drinking water standards[5] as well as the volume of a 4000-foot "buffer zone" surrounding that

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[4](State of New Mexico's Response and Memorandum in Opposition to Phillips Pipe Line Co., et al.'s Motion and Memorandum for Partial Summary Judgement Seeking Dismissal of Plaintiffs' Alleged Lost Services Claims Under CERCLA and Lost Use Claims at Common Law, filed September 16, 2002 (dkt. no. 769), at 2 ¶ 2.)

[5]The New Mexico Environmental Improvement Board's public water system regulations, NMAC §

(continued...)

plume required to prevent migration of the plume toward active wells; then Dr. Williams estimated the hydrological "safe yield" of the portion of the aquifer containing the estimated plume and buffer zone volumes as a means to estimate the alleged "lost safe yield" due to the contamination.

Plaintiffs having failed to raise a triable issue concerning loss of extractive services,[6] the court has framed the "injury" issue for trial solely in terms of Plaintiffs' alleged loss of *in situ* groundwater service: "What is the volume of *in situ* groundwater beneath the South Valley Site that has been injured and rendered unavailable (*e.g.*, as

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[5](...continued)
20.7.10.100, expressly adopt and incorporate by reference the safe drinking water standards promulgated by the Environmental Protection Agency (EPA) in 40 C.F.R. Part 141 (2002) (National Primary Drinking Water Regulations), including the EPA's Maximum Contaminant Level ("MCL") standards. (*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 36-37 & nn. 41-42.)

As used herein, chemical contaminants in "above-MCL" water exceed these standards, while those in "below-MCL"water do not. The reference to volume of "the plume" or "plume volume" in this Order comprehends the fact that Dr. Williams' modeling may project more than one discrete "above-MCL" contaminant plume attributable to one or more sources.

[6]Dr. Williams' "lost safe yield" estimates attempted to quantify Plaintiffs' alleged loss of extractive drinking water services. For the reasons explained below, however, Dr. Williams' proffered "lost safe yield" estimates are not admissible.

Plaintiffs also equate a loss of extractive services with a change in the point of diversion, arguing that the "loss of yield" from Albuquerque's San Jose well field "is in fact a loss of safe yield due to the contamination." (Plaintiff's Joint Response in Opposition to Motions to Exclude Dr. Dennis Williams, filed January 5, 2004 (dkt. no. 1052) ("Pltfs' Joint Resp. (Williams)"), at 14; *see id.* at 14-15 ("Water managers have had to abandon a portion of the South Valley wellfield area due to contamination and have lost the yield they could have had from this area . . . ."); Tr. 12/9/2003, at 2559:24-2562:19 (testimony of Dr. Williams).)

Yet if as Plaintiffs submit, "safe yield" must obey "the equation of hydrologic equilibrium, water balance or hydrologic budget (Inflow = Outflow ± Change in Storage)," (*id.* at 14), then a change in the geographic point of diversion of an equivalent volume of water from the same aquifer does not alter the equation or reduce the amount of available "safe yield."

In testifying about "lost safe yield" based upon closure of wells in the San Jose field, Dr. Williams did not account for the replacement of the San Jose wells with the Burton #4 Well in April 1987, which was accomplished as part of the EPA's remedial action at South Valley—remedial action requested and approved by the State of New Mexico. (*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 9 & n.2.)

drought reserve) for use as drinking water because of that chemical contamination [attributable to the Defendants]?" (*Id.* at 137.)

To be helpful to the trier of fact, the proffered expert opinion must "fit," *i.e.*, be relevant to at least some of the facts bearing upon the determination of this issue. To embrace the ultimate issue of injury under Rule 704(a), the proffered expert opinion should account for all of the material factors that bear upon that ultimate issue.

In this case, several material factors bear upon the issue of loss of *in situ* groundwater service as "drought reserve": (1) the total volume of groundwater[7] and the hydrological "safe yield" of the Middle Rio Grande Basin aquifer;[8] (2) the volume of groundwater polluted by contaminants exceeding New Mexico drinking water standards; (3) the volume of groundwater polluted by contaminants originating from sources other than the Defendants in this action; (4) legal or administrative restrictions on extraction of Middle Rio Grande Basin groundwater; (5) the exercise of existing water rights by water users, *e.g.*, the City of Albuquerque; and (6) in the specific context of this action, the volume of groundwater encompassed within the intended scope of the EPA "Plant 83/General Electric" remediation under the Comprehensive Environmental Response,

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[7]According to testimony in this record, the Middle Rio Grande Basin contains "1.2 billion acre-feet or more" of water, the upper zone of which "is used for water supply purposes" and contains approximately "440 million acre-feet" of water. (Transcript of Hearing, dated December 11, 2003, at 3043:18-3044:3 (testimony of Mr. Grisak).)

[8](*See* Transcript of Hearing. dated December 11, 2003 A.M. Session ("Tr. 12/11/2003 AM"), at 3047:1-4 (testimony of Mr. Grisak) ("[T]he concept of safe yield is, in fact, a basin-wide concept. It's not a localized concept, but it applies as the basin wide scale."); *id.* at 3046:5-3047:25 (surface water and aquifer are "fully interconnected" and safe yield may be drawn "from essentially anywhere in the basin.").)

Compensation and Liability Act of 1980 ("CERCLA"), Pub. L. 96-510, 94 Stat. 2767, *codified at* 42 U.S.C. §§ 9601 *et seq.* (2000). (*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 139.)[9]

D. Relevance & Admissibility: Fed. R. Evid. 401, 402, 403

"Relevant evidence" refers to "evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence." Fed. R. Evid. 401. Generally, "[a]ll relevant evidence is admissible" and "[e]vidence which is not relevant is not admissible," Fed. R. Evid. 402, but in practice, relevant evidence is excluded as required by the Constitution, the law, or court rules, such as the hearsay rule, Fed. R. Evid. 802, which in turn is subject to multiple exceptions. *See* Fed. R. Evid. 803. Moreover, relevant evidence that escapes these limitations may nevertheless be excluded "if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence." Fed. R. Evid. 403.

[9]At this point, the first triable issue framed by the court is: "What is the nature, location and extent (in both volume and concentration) of the chemical contamination of the groundwater underlying the South Valley Site *that exists beyond the reach of CERCLA (e.g., petroleum hydrocarbons only) and/or outside the intended scope of the existing EPA remediation*?" ((Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 139 (emphasis added); *see id.* at 69-72 (conflict preemption under CERCLA).) Plaintiffs' claims do not reach chemical contaminants within the scope of the ongoing EPA remediation.

II. ANALYSIS & FINDINGS RE: EXPERT WITNESSES

A. Plaintiffs' Damages Experts: Dr. Brookshire & Mr. Johnson

Recently, this court ruled upon the scope of Plaintiffs' remaining state law claims and the appropriate measure of damages to be applied at trial. (*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 64-82, 117, 132-141.) The court's rulings have rendered significant portions of the testimony of Plaintiffs' damages experts, Dr. David S. Brookshire and Mr. Stephen B. Johnson, irrelevant to the remaining triable issues.

Dr. Brookshire's analysis and opinions concerning the market value replacement cost of a volume of groundwater totally and permanently lost to use has no bearing upon damages to be measured by the cost of restoration of the affected groundwater to use as drinking water, and therefore cannot be helpful to the trier of fact in this case.[10]

Similar analysis and opinion testimony by Mr. Johnson concerning the cost of replacing the storage capacity of a portion of the Middle Rio Grande Basin aquifer through construction and maintenance of a large surface storage reservoir likewise cannot be helpful to the trier of fact where the Plaintiffs have no cognizable claim for loss of the aquifer's storage capacity. (*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 30.)

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[10] *Fashion Boutique of Short Hills, Inc. v. Fendi USA, Inc.*, 75 F. Supp. 2d 235, 238 (S.D.N.Y. 1999) ("expertise in valuation is only helpful to the trier of fact if it is applicable to the facts of this case."; expertise is "not helpful to the extent that it is based upon a[n] . . . assumption that plaintiff cannot prove.").

The court need not examine the Rule 702 *reliability* of Dr. Brookshire's market value replacement cost computations or Mr. Johnson's construction and water replacement cost estimates because neither analysis remains *relevant* to the issues remaining to be tried. *See Kerrigan v. Maxon Ind.*, 223 F. Supp. 2d 626, 638-39 (E.D. Pa. 2002) ("'There must be a valid connection between the expertise in question and the inquiry being made in the case.' *Main Street Mortgage v. Main Street Bancorp, Inc.*, 158 F. Supp.2d 510, 518 (E.D. Pa. 2001).")

Mr. Johnson also offered opinion testimony concerning the advisability of wellhead treatment to restore contaminated groundwater beneath the South Valley Site to use as drinking water. (Transcript of Hearing, dated December 10, 2003 A.M. Session ("Tr. 12/10/2003 AM"), at 2782:20-2785:18, 2796:25-2798:17 (testimony of Stephen Johnson).) In this respect, Mr. Johnson largely summarizes his observations as to his own experience and the experience of others in designing and implementing wellhead treatment systems at other locations.[11]

As to this portion of Mr. Johnson's proffered testimony, the Defendants object that his proffered opinion is "litigation driven," and "not followed by Mr. Johnson in his practice outside the courtroom," where "he has never advised a client that groundwater

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[11]Mr. Johnson holds a Bachelor's Degree in Civil Engineering from California Polytechnic University, in Pomona, California, and is a registered and licensed civil engineer; he is vice president of Stetson Engineering, where he has worked since 1977. His work experience includes consulting on water resource management in the San Gabriel Valley and serving as project manager for one operable unit of an EPA-supervised groundwater remediation in the San Gabriel Basin, among other assignments. (Tr. 12/9/2003, at 2655:12-2662:21 (testimony of Mr. Johnson).)

contaminated with volatile organic compounds at levels below drinking water standards is permanently lost for all beneficial uses," (GE Supp. Mem. at 22 (citing Transcript of Hearing, dated December 10, 2003 PM Session ("Tr. 12/10/2003 PM"), at 2835:11-2837:4, 2869:7-2870:25, 2872:19-2875:5 (testimony of Stephen Johnson))), and that his "opinion regarding the viability of wellhead treatment is not based on any kind of scientific or empirical analysis" and "conflicts with his prior experience and that of the State of New Mexico," and should therefore be excluded. (Defs. Supp. Br. at 37-38.) Plaintiffs did not respond to these objections. (*See* Plaintiff's Joint Opposition to Various Motions to Exclude Stephen Johnson, filed January 5, 2004 (dkt. no. 1051); *cf.* Transcript of Hearing, dated January 8, 2004 P.M., at 4128:24-4129:10 (Mr. Lewis); *id.* at 4136:15-4137:6 (Mr. Fowler).)

At this point, the court concludes that portions of Mr. Johnson's opinion testimony concerning wellhead treatment as a remedy at South Valley are admissible at least as a summary of the experience of someone working in the field.[12]

B. Dr. Dennis E. Williams

Originally, Plaintiffs asked Dr. Williams to quantify the loss of groundwater "safe yield" and the total volume of *in situ* groundwater that has been lost to use because of the chemical contamination at South Valley. Acting upon Plaintiffs' request, Dr. Williams

[12]Mr. Johnson's opinion testimony concerning "lost safe yield" did not raise a triable issue concerning "total and permanent loss" of the resource; he did not testify to any analysis demonstrating that the resource is incapable of restoration; instead, he simply assumed that no further remediation or restoration would take place.

> made an estimate of the initial contamination of the plumes, and then using groundwater hydrologic models, I simulated the plumes forward into time, and then estimated the loss of safe yield and the volume of the aquifer. So those essentially are . . . the three main tasks that I was charged with.

(Transcript of Hearing, dated December 9, 2003 ("Tr. 12/9/2003"), at 2398:3-10 (testimony of Dr. Williams).) The question now presented is whether it is reasonable to use Dr. Williams' modeling approach, along with Williams' "particular method of analyzing the data, to draw a conclusion regarding the particular matter to which the expert testimony [is] directly relevant," *Kumho Tire*, 526 U.S. at 154 (emphasis in original), in this case, the question of contaminant plume volume and the consequences that may flow from that estimate.

1. Dr. Williams' Plume Volume & "Buffer Zone" Estimates

Dr. Williams, assisted by others, gathered the available South Valley well sampling data from Jacobs Engineering and other sources,[13] primarily from the last quarter of the year 1992,[14] and selected data to construct a model of a contaminant plume circa 1992.[15] (*Id.* at 2420:23-2421:22.) Those at the GEOSCIENCE firm who were assisting Dr. Williams used the technique referred to as "kriging"[16] to predict the

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[13](*See* Tr. 12/9/2003, at 2408:9-2410:2 (testimony of Dr. Williams).)

[14](*See* Tr. 12/9/2003, at 2628:24-2630:15, 2646:13-2647:17 (testimony of Dr. Williams).)

[15]Dr. Williams also gathered and reviewed information on the geological framework beneath South Valley, calling upon John Hawley, Mike Kernodle, and other local specialists. Hawley and Kernodle subsequently reviewed Williams' work. (Tr. 1/9/2003, at 2404:20-2408:1 (testimony of Dr. Williams).)

[16]"Kriging" refers to a statistical technique used with variograms, or two-point statistical functions that

(continued...)

measurements for geographic points within the plume model where actual 1992 sample data were not available. (*Id.* at 2404:3-8, 2410:19-2415:7, 2415:19-2419:23, 2645:15-2647:17.)[17]

> [W]e took the Jacobs database, and it goes in and we developed -- we did two steps on the kriging. The first, we kriged the plumes, we used the data to develop the variogram, which is the spatial relationship between the data, and we used that experimental variogram and then the model variogram which resulted from that, to krig the data into our groundwater model cells.

(Tr. 12/9/2003, at 2422:1-8.)

Next, Dr. Williams and his associates generated a groundwater flow model,[18] and used actual and "kriged" contaminant data in constructing solute transport models based

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[16](...continued)
describe the increasing difference or decreasing correlation between sample values as separation between them increases, to determine the value of a point in a heterogeneous grid using known values nearby.

[17]Ailco Wolfe, Johnson Yeh, and Georgina King of GEOSCIENCE performed the actual "kriging," or statistical interpolations, performing more than 100 computer exercises to refine the kriging results. (Tr. 12/9/2004, at 2610:7-2612:2; Declaration of Dennis E. Williams, Ph.D. in Opposition to Defendants' Various Motions to Exclude the Expert Testimony of Dr. Williams at Trial, dated August 30, 2002, at 4 ¶12.)

[18]As Dr. Williams explained:

> The one model, the industry standard, is the USGS model called MODFLOW, and we simulate water supply. But it's been extensively peer-reviewed. It's pretty much the worldwide standard in the groundwater flow.
>
> Q And that's what you used?
>
> A Yes. It simulates -- we simulated groundwater flow, both historic and in the future, and we used this to provide information for the solute transport models to move the plumes from 1992 to 2030.

(*Id.* at 2431:20-2432:5.)

on the groundwater flow model,[19] all in an effort to predict the geographic movement of the contaminated South Valley groundwater over a period of time. (*Id.* at 2398:5-6, 2422:9-2425:13, 2427:6-15, 2438:14-2439:17, 2440:17-2445:3, 2448:2-2449:8, 2456:18-2458:20, 2459:14-2465:7, 2470:10-2476:13.)

Having thus modeled the approximate volume, location and directional flow of the projected contaminant plume beneath the South Valley Site at specific points in time, Dr. Williams then analyzed the contamination problem in terms of long-term *containment*:

> The basic principle of delineating, when you have a groundwater contamination problem, the first thing you need to do is understand where it is. In other words, where it is spatially, where it is vertically. So you go through a series of testing, usually drilling, measurements and you want to define the plume and make sure that you certainly understand the margins of the plume, where it is laterally, where it is vertically.
>
> And then the second issue is *to contain the plume*, to try to minimize the spread of the contamination, so to protect the fresh drinking water supplies.

(Tr. 12/9/2003, at 2397:6-18 (testimony of Dr. Williams) (emphasis added).) Dr. Williams hypothesized the volume of a "buffer zone" of potable water surrounding the contaminant plume that must remain in place to prevent further movement or flow of the modeled contaminant plume in the direction of active water supply wells. (*Id.* at

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[19]Dr. Williams outlined the "three steps in the model construction":

> The conceptualization, which is really getting the correct geologic framework. Then building the model and calibrating it, making the model believable. Does the model predict what happened in the real world from the measured date data? And then predicting -- once the calibrated model is finished, then you predict the plumes into the future.

(*Id.* at 2456:9-17.)

2495:18-2509:5, 2512:2-2513:20, 2527:1-18.)[20]

Dr. Williams combined the estimated volume of his modeled contaminant plume with the estimated volume of the "buffer zone" needed to immobilize the plume to estimate the total volume of *in situ* groundwater impacted by the contamination and thereby lost to use as drinking water over a period of time, and to estimate the lost "safe yield" of potable groundwater from the South Valley portion of the Middle Rio Grande Basin aquifer, past, present and future. (*Id.* at 2514:4-2515:7, 2524:2-2525:22, 2554:21-2555:11.)[21]

> Q So in terms of alleging -- of talking about the alleged loss of the use of groundwater, what you're talking about is the alleged loss of safe yield[?]
>
> A When you talk of the loss of on an annual basis, that's correct.

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[20]Dr. Williams delineated his current buffer zone boundary as "the outer limit of the capture zones for four hypothetical production wells placed at such a distance that their production would not alter the size, shape, or movement of the plume." (*Id.* at 2588:3-7.)

[21]According to the Plaintiffs, "safe yield" refers to "the amount of water that can be extracted from an aquifer on an annual basis without depleting the size of the aquifer in the ground. It is an aquifer-specific number that depends on a myriad of factors, including the recharge zones, annual precipitation of the area, hydrogeology of the aquifer, etc." (State of New Mexico's Response and Memorandum in Opposition to Phillips Pipe Line Co., et al.'s Motion and Memorandum for Partial Summary Judgement Seeking Dismissal of Plaintiffs' Alleged Lost Services Claims Under CERCLA and Lost Use Claims at Common Law, filed September 16, 2002 (dkt. no. 769), at 4 n.3.)

According to Dr. Williams, "safe yield goes back to the fundamental laws and principles governing the science of groundwater, basically conservation of mass. In fact, the most complicated of all the models rely on a very fundamental principle, and that is, inflow equal[s] outflow plus or minus change in storage."

> It's like your bank account. If you write too many checks and you don't put enough in, your balance goes down. So it's the same with groundwater hydrology. It's an inflow, the recharge, outflow, pumping or other outflow, and then change in groundwater storage.

(Tr. 12/9/2003, at 2402:17-2403:4 (testimony of Dr. Williams).) Safe yield, then, "is basically an equalization of what's going in and what's coming out." (*Id.* at 2517:10-11; *see also* Pltfs' Joint Resp. (Williams) at 12-14 ("safe yield" defined).)

(*Id.* at 2555:1-6.)[22]

2. Defendants' Rule 702 and Relevancy Objections

The Defendants object that the analysis and opinions of Dr. Dennis E. Williams proffered at the December 9 evidentiary hearing "are irrelevant to the elements of injury and damages and cannot assist the trier of fact in resolving these issues." (Supplemental Memorandum of Defendant General Electric Company in Support of Motion to Exclude Expert Testimony of Dennis Williams, David Brookshire and Stephen Johnson, filed January 9, 2004 (dkt. no. 1058) ("GE Supp. Mem."), at 1.) General Electric argues that Dr. Williams avoids the question "whether — and to what extent — the presence of contamination in excess of drinking water standards has deprived the State of the opportunity to make water available for appropriation by others," the "sole question that the Court has found to be relevant." (*Id.* at 3.) In other words, Dr. Williams has not framed his opinions in terms of the ultimate "injury" issue.[23] GE also objects that Dr. Williams' opinions "are neither supported by sufficient facts or data, nor are they the product of reliable principles and methods reliably applied to the facts of this case," and

[22]Dr. Williams explained that he "estimated the loss of use of groundwater based on the area including the buffer zone of the contaminant. When that water is lost not only the safe yield is lost, but the volume of water beneath that contaminated plume and buffer zone is lost." (*Id.* at 2555:21-2556:1.)

[23]While relevant expert opinion testimony "is not objectionable because it embraces an ultimate issue to be decided by the trier of fact," Fed. R. Evid. 704(a), the Rule does not *require* an expert's opinion to address an ultimate issue.

should therefore be excluded under Rule 702. (*Id.* at 2.)[24]

ACF Industries, Chevron and Texaco similarly contend that Dr. Williams' opinions "are not the product of reliable methods," are "based . . . on mistaken assumptions and improper calculations," are not reliable "because they do not reflect reality," and are "not relevant to the case because they fail to comply with the Court's rulings on the measure of injury, which is limited to contamination above the federal and state drinking water standards." (Defendants' Supplemental Brief in Support of Motions to Strike the Testimony of Dennis Williams, Stephen Johnson and David Brookshire, filed December 29, 2003 (dkt. no. 1044) ("Defs. Supp. Br."), at 2, 3.) In particular, Defendants argue, Dr. Williams erroneously opines that "hundreds of thousands of acre feet of uncontaminated water are lost," apparently referring to Williams' projected "buffer zone" volume. (*Id.* at 4.) Not only do Williams' opinions fail to meet Rule 702 standards, the Defendants continue, they should be excluded under Fed. R. Evid. 403 because they may confuse and mislead the jury, citing *In re TMI Litigation*, 911 F. Supp. 775, 798-99 (M.D. Pa. 1996), and *C.A. Assocs. v. Dow Chemical Co.*, 918 F.2d 1485 (10th Cir. 1990). *See also* Fed. R. Evid. 401, 402.

The Defendants challenge the relevance and reliability of each step of Dr.

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[24]General Electric further argues that Dr. Williams' analysis is not relevant to the first phase issue of injury because "[e]ven with its gross exaggeration of the plume, Williams' model confirms that the General Electric deep zone remedial system *will restore groundwater to drinking water standards no later than 2016.* . . . While the model predicts that a chlorinated solvent plume emanating from the Univar site will persist beyond that date, that plume is not relevant to the present case." (GE Supp. Mem. at 10 (emphasis added & citation omitted).) If in fact Dr. Williams' modeling demonstrates that the existing EPA/GE system will effectively remediate the Plant 83 contaminants by 2016, that analysis would seem very relevant indeed.

Williams' analysis. *See Dodge v. Cotter Corp.*, 328 F.3d at 1222 ("Under *Daubert,* 'any step that renders the analysis unreliable . . . renders the expert's testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology.' *Mitchell,* 165 F.3d at 782 (quoting *In re Paoli R.R. Yard PCB Litigation,* 35 F.3d 717, 745 (3d Cir. 1994)).").

3. Dr. Williams' Qualifications

The first question under Rule 702 is whether the proposed witness is a qualified expert in the area in which he is being offered as an expert, *viz.*, "geohydrology" (or "hydrogeology") and groundwater hydrology, including modeling techniques useful to groundwater hydrology.

Dr. Williams is a Research Professor at the University of Southern California, has taught courses in the subject since 1980, and serves as director of the university's geohydrologic laboratory; he is a registered geologist and certified hydrogeologist in the State of California and a member of the American Institute of Hydrology, and has authored thirty publications. (*See* Tr. 12/9/2003, at 2389:11-2394:11 (testimony of Dr. Williams).) His groundwater consulting company, GEOSCIENCE Support Services, has conducted business for more than 25 years, mainly working with municipalities and water districts in California and elsewhere. (*Id.* at 2394:12-2395:21.) Dr. Williams has performed groundwater analyses and modeling in order to define plumes of contaminated water for various clients. (*Id.* at 2395:22-2396:25, 2422:17-2431:14, 2445:14-2446:3.)

The computer-assisted groundwater modeling tools he uses are widely known and well recognized. (*Id.* at 2431:20-2437:11, 2449:21-2456:8.)

Based upon the written materials and testimony in the record, the court is satisfied that based upon his knowledge, education, training and experience in the field, Dr. Williams is a qualified expert in the area in which he is being offered.

4. Groundwater Flow/Contaminant Transport Modeling

Assuming relevance, the next question under Rule 702 is whether the proposed expert testimony "is the product of reliable principles and methods." Fed. R. Evid. 702.

The Defendants contend that Dr. Williams' groundwater flow and contaminant transport modeling "does not reflect reality," and involve the "use of flawed software" with a starting point "based on incomplete data and unreliable kriging," *viz.*, the 1992 plume model. (Defs. Supp. Br. at 6.) According to General Electric, Dr. Williams' modeling predicts a plume volume of 15,000 acre-feet by 2003, yet "the actual groundwater quality data for the same period shows that vast areas within Williams' predicted plume are either entirely uncontaminated or have chemicals at concentrations below the maximum contaminant levels for drinking water," suggesting that "Williams' massive plume does not exist in the real world." (GE Supp. Mem. at 10.) "Consequently, both the model and the Williams opinions based on the model should be excluded from evidence at trial as not accurate and therefore not reliable." (*Id.* at 13.)

5. Reliability, Uncertainty & "Kriging"

"Kriging" serves as a method for estimating specific values of data where the actual values have not been measured. Kriging involves interpolation of known (measured) values to infer the missing values for adjacent data points or locations where no measurement was made. (*See* Tr. 12/9/2003, at 2645:18-21 (testimony of Dr. Williams).) Kriging necessarily is rooted in knowledge and/or statistical assumptions concerning the nature, properties, and behavior of the subject matter—in this case, groundwater containing dissolved traces of several organic chemicals that may migrate through the heterogenous geological constituents of an aquifer,[25] depending upon the effect of various hydraulic forces over time. Moreover, "All interpolation methods are based on a rather intuitive idea, namely that the concentrations of a contaminant are more 'similar' for a pair of locations that are close together and less 'similar' for locations that are far apart."[26]

> That is, the degree of correlation between concentration values for a pair of values is a function of distance and direction. One crucial problem is how to quantify this correlation and in particular how to do it for a particular application, i.e., how to use the data for this purpose. There is seldom ever sufficient information available . . . that would allow a mathematical derivation of the spatial correlation function. Instead it must be estimated

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[25]Generally, the term "aquifer" refers to a geologic formation (or more than one geologic formations) that is porous enough and permeable enough to transmit water at a rate sufficient to feed a spring or a well, *i.e.* to provide "extractive services." Aquifers are thus defined in terms of how quickly water may pass through the constituent materials rather than in terms of particular geological constituents (sand, gravel, clay, sandstone, etc.).

[26](Expert Report of Donald E. Myers, Ph.D. Concerning the Use of Geostatistics for Analyzing Groundwater Contamination Data in the South Valley, Albuquerque, Ne Mexico, dated March 29, 2002 ("Myers 3/29/2002 Report"), at 6, Exhibit "L" of Plaintiffs' Appendix of Exhibits in Support of Plaintiffs' Consolidated Response in Opposition to Defendants' Motion to Exclude Testimony of Plaintiffs' Expert Dennis E. Williams at Trial, filed September 16, 2002 (dkt. no. 766).)

and modeled from the data. . . .[27]

Kriging thus yields *estimated* values—estimates that are themselves rooted in estimates.

Geostatistical methods, and kriging in particular, are recognized and accepted *estimation* techniques that find useful application in various contexts. These methods prove to be inescapably uncertain:

> Absent complete information on the deposition process and absent detailed information on the geohydrological parameters (such as hydraulic conductivity, dispersivity, permeability, etc.) for the subsurface it will not be possible to perfectly determine the concentrations at non-sampled points. Therefore any interpolation method will incorporate some degree of uncertainty, hence the emphasis on the word "estimate" or "predict". . . . Geostatistics and the various forms of kriging incorporate uncertainty in the methodology. . . .[28]

Plaintiffs' experts concede that Dr. Williams' approach is not the only valid method for estimating the location and volume of a plume of contaminated groundwater, and that other geostatistical methods may be applied to the available data to perform the same task, with varying results.[29] To some extent, the Defendants' experts have used alternate estimation techniques in evaluating Dr. Williams' results, and have tested and compared Dr. Williams' projected plume volume and estimated concentrations against "real-world data"—actual field measurements at corresponding data points collected

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[27](*Id.* at 7.)

[28](*Id.* at 3.)

[29](*Id.* at 5 ("There are at least three approaches that might be used.").)

since the last quarter of 1992.[30] These analyses and comparisons suggest that Dr. Williams' projections overestimate the plume volume, predicting above-MCL groundwater contamination in 2003 at locations where such contamination did not exist in 2003, (Tr. 12/10/2003 PM, at 2916:6-2925:4 (testimony of Steven Larson)), and understate the effectiveness of the ongoing remediation, which Defendants' experts opine will eliminate any above-MCL contaminant plume by the year 2016, even using Williams' model as a basis. (*See id.* at 2946:14-2948:5; *cf.* Transcript of Hearing, dated December 11, 2003 P.M. Session ("Tr. 12/11/2003 PM"), at 3445:14-21, 3447:11-3448:21 (testimony of John A. Connor).)

6. Reliability, Helpfulness & Relevance

By definition, Dr. Williams' estimates and projections of plume volume, location and movement over time cannot produce a result with mathematical certainty. Yet they need not promise mathematical certainty in order to be "helpful to the trier of fact"—the third essential query under Rule 702. While expert opinions "must be based on facts which enable [the expert] to express a reasonably accurate conclusion as opposed to conjecture or speculation, . . . absolute certainty is not required." *Gomez v. Martin Marietta Corp.*, 50 F.3d 1511, 1519 (10th Cir. 1995) (quotation omitted).

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[30]The Defendants complain that work papers pertinent to GEOSCIENCE's kriging exercises have been lost, discarded or destroyed, making it impossible to examine or replicate the work actually done. (*See* Tr. 12/9/2003, at 2606:25-2615:10, 2617:1-2619:21, 2620:2-2621:1 (testimony of Dr. Williams).) Nevertheless, the Defendants' experts were able to test Williams' modeling and compare the results using differing data selections.

In the context of this civil action, we are concerned with facts proven by a preponderance of the evidence, that is, with things more likely than not; we make findings as to that which is *probable*, though still uncertain. Statistical techniques address facts, values and quantities in terms of *probabilities*, not certainties—varying shades of grey rather than bold contrasts of black and white. The geostatistical language of probability meshes with the legal language of preponderance, and an analysis expressed in one may assist in resolving an issue expressed in the other. Or it may not.

"Trained experts commonly extrapolate from existing data. But nothing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." *General Electric Co. v. Joiner*, 522 U.S. 136, 146 (1997). As to *admissibility* of expert opinion, the question is whether "there is simply too great an analytical gap between the data and the opinion proffered." *Id.*[31]

The court has heard and considered in some detail the Defendants' experts' critique of the analyses performed by Dr. Williams in formulating his proffered opinions. The arguments concerning GEOSCIENCE's "kriging" analysis re-emphasize the inherent difficulty of quantifying empirical values where those values have not in fact been measured in the field. Indeed, where the accuracy and precision of stated quantities of

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[31] In *Joiner*, the district court found such a gap, excluding the opinions of Dr. Daniel Teitelbaum, among others, that occupational exposure to polychlorinated biphenyls (PCBs), dibenzofurans and dibenzodioxins had caused plaintiff's small-cell carcinomas. The Supreme Court affirmed. 522 U.S. at 143-47.

hazardous substances are important, "'[t]here is no substitute for measurement.'" *Allen v. United States*, 588 F. Supp. 247, 380 (D. Utah 1984), *rev'd on other grounds*, 816 F.2d 1417 (10th Cir. 1987), *cert. denied*, 484 U.S. 1004 (1988).

One area of vulnerability of Williams' projected plume is its apparent conflict with actual below-MCL or "non-detect" measurements obtained from samples collected in the field. (*Compare* Tr. 12/9/2003, at 2615:11-2616:20, 2651:18-2652:18 (testimony of Dr. Williams) *with* Tr. 12/10/2003 PM, at 2916:6-2925:4 (testimony of Steven Larson); Tr. 12/11/2003 AM, at 3066:22-3067:17 (testimony of Mr. Grisak); Tr. 12/11/2003 PM, at 3407:5-3408:19 (testimony of Mr. Connor).)[32]

Defendants' experts criticize the calibration of Dr. Williams' modeling, asserting that Williams and his associates used the wrong method for "relative error" calculation (Tr. 12/10/2003 PM, at 2925:5-2929:2, 2930:18-2933:7 (testimony of Mr. Larson); Tr. 12/11/2003 PM, at 3401:11-3407:4 (testimony of Mr. Connor)), and that sufficient measurement data is available to render modeling unnecessary. (*Id.* at 3446:3-13.)

Plaintiffs respond that Dr. Williams' modeling was properly calibrated, that the relative error comes well within the "industry standard" of ten percent, and need not be calculated using the logarithms of concentration, or the standard deviation. (*See* Pltfs' Joint Resp. (Williams), at 9-10.) They point to Well P83-22D-2, which when drilled in

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[32]Defendants argue that "[m]odel-based opinions are of no value to a trier of fact where they are contrary to real world data," citing *Ramsey v. Consolidated Rail Corp.*, 111 F. Supp.2d 1030, 1037 (N.D. Ind. 2000), and *In re TMI Litigation*, 193 F.3d 613, 671 (3d Cir. 1999), *amended on other grounds*, 199 F.3d 158 (3d Cir.), *cert. denied*, 530 U.S. 1225 (2000). (GE Supp. Mem. at 10 n.2.)

February 2002, detected contaminants as predicted by the Williams modeling. (*Id.* at 10.)

"Does the model predict what happened in the real world from the measured . . . data?" (Tr. 12/9/2003, at 2456:13-15 (testimony of Dr. Williams).) From the facts currently in this record, it appears that Dr. Williams' analysis gives some rough *estimate* of the nature, extent, and location of contaminated water beneath the South Valley Site based upon selected data, and the relationship between model and measurements in this instance is something more than purely *ipse dixit.*[33] Defendants' criticisms of Dr. Williams' methods of analysis—including the GEOSCIENCE kriging and calibration exercises—are themselves based upon statistical probabilities and estimation techniques, and go to the weight and credibility that the trier of fact should afford to Dr. Williams' opinions.

The statistical tools and methods used by Dr. Williams and his associates in making estimates appear to have "'a grounding in the methods and procedures of science' based on actual knowledge, not 'subjective belief or unsupported speculation.'" *Dodge v. Cotter Corp.*, 328 F.3d at 1222 (quoting *Daubert,* 509 U.S. at 590). His estimates appear to have "'a reliable basis in the knowledge and experience of [the relevant] discipline,'" *Kumho Tire*, 526 U.S. at 129 (quoting *Daubert*, 509 U.S. at 592), and appear to be "applicable to a particular set of facts" as required by Rule 702. *Daubert*, 509 U.S. at 593. Dr. Williams' estimates do not fall "outside the range where experts may reasonably

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[33] *See* Black's Law Dictionary 833 (Bryan A. Garner ed., 7th ed. 1999) ("***ipse dixit*** [Latin 'he himself said it'] Something asserted but not proved. . . .")

differ, and where the jury must decide among the conflicting views of different experts, even though the evidence is 'shaky.'" *Kumho Tire*, 526 U.S. at 153.

But to be admissible, those estimates must also prove to be *relevant* to the triable issues in this case.

7. Plume Volumes & Contaminants Attributable to Non-Parties

To be relevant to the issues of injury and damages in this case, Dr. Williams' estimate of plume volumes must encompass chemical contaminants that allegedly may be traced to the conduct of the Defendants named in this action. At least to the extent that it may be distinguished, contamination that is known or believed to be identifiable to non-party sources, *e.g.*, the Univar Edmunds Street facility, has no bearing upon the issues to be tried in this case, and should form no part of any expert analysis of the nature, location or volume of contaminated groundwater to be proffered at trial.

Dr. Williams acknowledges that his projected plume volume includes contaminants attributed to the Univar Edmunds Street facility:

> Q You would agree, would you not, that there is a plume of contamination known as the Univar plume that is separate and distinct from the GE plume, the GE-managed plume?
>
> A Yes.
>
> . . . .
>
> Q You included contamination data from the Univar site in your model; isn't that correct?
>
> A Yes.

(Tr. 12/9/2003, at 2585:8-12, 2586:2-5 (testimony of Dr. Williams).)

According to Steven Larson, one of the Defendants' experts, Dr. Williams' projected 2003 plume volume of approximately 15,000 acre-feet incorporates significant non-party contamination: "The plume associated with the Univar monitoring wells was a little over 50 percent of that total calculated contamination exceeding drinking water standards." (Tr. 12/10/2003 PM, at 2946:3-6 (testimony of Steven Larson).) Benzene contamination accounted for nearly 25 percent of Dr. Williams' projected 2003 plume volume, (*id.* at 2945:21-25), but benzene is concentrated under the Univar site. (Tr. 12/9/2003, at 2649:4-14 (testimony of Dr. Williams.)

To the extent that Dr. Williams current plume volume projection takes into account identifiable, distinguishable non-party source contamination (*e.g.*, the "Univar plume"),[34] that projection must be excluded because it is not applicable to the facts properly before the court, *i.e.*, not relevant, and likely would be confusing, misleading and needlessly prejudicial. Fed. R. Evid. 401, 403.

8. "Buffer Zone" Volume & Loss of Extractive Services

The Defendants also assail Dr. Williams' estimated "buffer zone" (and "alternate buffer zone"[35]) volumes, arguing that his projected buffer zone is comprised of potable

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[34]Defendants' expert suggests that if the Univar plume data is excluded from Dr. Williams' model, no contaminant plume exceeding drinking water standards will exist by the year 2016. (*See* Transcript of Hearing, dated December 10, 2003, at :2942:14-2945:17 (testimony of Steven Larson).)

[35](Tr. 12/9/2003, at 2586:6-2592:3, 2592:23-2600:5 (testimony of Dr. Williams).)

groundwater that has not been lost to use because of contamination, and cannot be deemed to be part of any alleged injury to the State's interest. Plaintiffs respond that the buffer zone is necessary to prevent migration of the plume of "above-MCL" contaminated groundwater through the aquifer, which could threaten to taint existing or future supply wells.

In this case, Dr. Williams' estimated "buffer zone" volume is relevant the Plaintiffs' claims only if the contaminated plume volume is treated as totally and permanently lost and the remedy chosen to address the resulting public health risks is the passive *containment* of the chemical contaminant plume. By definition, Dr. Williams' "buffer zone" volumes fall beyond the boundaries of the estimated "above-MCL" contaminant plume, and are usable as drinking water. (*See* Tr. 12/9/2003, at 2565:7-23, 2567:11-17, 2568:14-19 (testimony of Dr. Williams).)

In light of this court's rulings on the appropriate measure of damages in light of Plaintiffs' failure to raise a triable issue as to total and permanent loss, (*see* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 55-64,132-35), Dr. Williams' original and alternative "buffer zone" estimates are not relevant to the issue of injury to the State's interests in groundwater caused by contamination attributable to the defendants.

9. Estimated Plume Volume & the Ongoing EPA Remediation

To be helpful to the trier of fact, Dr. Williams' plume volume modeling must

predict the quantity and location of persistent above-MCL groundwater contamination *outside* the scope of the existing EPA/GE remediation, excluding contaminated water within its reach.

To some extent, at least, Dr. Williams' projected plume volume predicts persistent contamination beyond the reach of the existing remedial system. In the Declaration of Dr. Dennis E. Williams, dated August 30, 2002,[36] he observed that based upon his groundwater flow and transport modeling of the contaminant plume, "the GE pump and treat system does not remediate contaminants outside the capture radius of its extraction wells, which leaves a significant amount of the total contaminant plume unremediated." (*Id.* at 7 ¶ 20.) "Consequently," Dr. Williams continues, "the contaminants will persist in the groundwater for at least two hundred years, or even longer, after the remediation efforts have ceased in year 2020." (*Id.*) By the time of his testimony on December 9, 2003, Dr. Williams had softened this estimate somewhat, predicting that the contaminant plume would persist for "at least 100 years, and probably longer," taking into consideration the EPA/GE remediation system, (Tr. 12/9/2003, at 2541:9-10, 2542:1-2543:3), but he observed that there are "deep hits that are below the depth of the deepest GE extraction well," (*id.* at 2650:11-12): "the deep zone [remediation system] doesn't go much below 4,600 feet, [and] there's some known contamination quite a bit deeper," (*id.*

[36](State of New Mexico's Response and Memorandum in Opposition to Phillips Pipe Line Co., et al.'s Motion and Memorandum for Partial Summary Judgement Seeking Dismissal of Plaintiffs' Alleged Lost Services Claims Under CERCLA and Lost Use Claims at Common Law, filed September 16, 2002 (dkt. no. 769), at Exh. 1.)

at 2542:17-19), as reflected in data gathered in connection with the EPA/GE remediation. (*Id.* at 2465:24-2466:22, 2467:3-2470:2, 2491:18-2492:1, 2493:10-2494:25, 2531:21-2541:10, 2542:12-2548:22.)

Part of that persistent contamination appears to be attributable to the Univar Edmunds Street facility, as discussed above, and to be helpful to the trier of fact, Dr. Williams' plume volume estimates must explicitly address only the contamination attributable to the Defendants, and then only to the extent that it persists beyond the scope of the EPA/GE remediation.

10. Reliability of Dr. Williams' Methods and Application

At this stage, having reviewed and considered the testimony proffered at the evidentiary hearing, as well as the memoranda submitted by counsel and references cited by the witnesses, the court is persuaded that the groundwater flow and solute transport modeling tools used by Dr. Williams and his associates at GEOSCIENCE, including the interpolation of data values using "kriging," are generally accepted in the field of geostatistics and are generally considered to be reliable as tools to be used to arrive at an *estimate*,[37] recognizing at the same time that an estimate proves inescapably uncertain.[38]

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[37](*See, e.g.*, Tr. 12/10/2003 PM, at 2990:20-2991:1 (testimony of Mr. Larson); Tr. 12/11/2003 AM, at 3096:24-3098:12 (testimony of Mr. Grisak); Transcript of Hearing, dated January 7, 2004 P.M. Session, at 3762:6-3776:21 (testimony of Dr. Myers).)

[38] Q. There is no way to determine the accuracy of Dr. Williams' Kriging for points where there is no actual data available; isn't that true?

A. That's true in general.

(continued...)

More problematic is the question whether Dr. Williams and his associates "applied the principles and methods reliably to the facts of the case," Fed. R. Evid. 702, in performing their analyses and preparing their estimates. As his opinions have evolved in this proceeding, Dr. Williams has acknowledged errors in his original analyses in light of certain critiques of his work by the Defendants' experts. (Tr. 12/9/2003, at 2601:21-2603:2.) Other criticisms appear to reflect differing preferences in approach to geostatistical analysis, *e.g.*, hand-contouring vs. kriging of estimated values, or use of various functions in calibrating models and computing relative error.[39] Each approach has its advocate, and Dr. Williams' geostatistical preferences have their own advocate as well. (*See* Transcript of Hearing, dated January 7, 2004 P.M. Session ("Tr. 1/7/2004 PM"), at 3762:6-3776:21 (testimony of Dr. Donald E. Myers).)

Looking to the *Daubert* factors, (1) Dr. Williams' modeling analysis is susceptible to, and has been subject to testing by Defendants' experts;[40] (2) Dr. Williams recounts

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[38](...continued)
(Transcript of Hearing, dated January 7, 2004 P.M. Session, at 3812:9-12 (testimony of Dr. Myers).)

[39]For example, Mr. Larson asserts that the relative error should be computed using the standard deviation of the residuals, *i.e.*, the difference between the "model computed concentration and the measured concentration" of contaminants, rather than dividing that value by the range of the available data, as Dr. Williams did. (Tr. 12/10/2003 PM, at 2927:1-2929:2 (testimony of Mr. Larson). Mr. Connor, in contrast, suggests that using logarithms of the concentrations is the preferable method. (Tr. 12/11/2003 PM, at 3403:4-3407:4 (testimony of Mr. Connor).)

[40]Defendants complain that they cannot *replicate* the GEOSCIENCE kriging, sensitivity and calibration analyses because the pertinent work papers have been discarded. However, the modeling software applications are familiar to their experts, who report having performed tests on Dr. Williams' current modeling, with varying results.

some minimal peer review of his groundwater flow modeling, (Tr. 12/9/2003, at 2624:6-2627:12, 2643:5-2645:14), and Plaintiffs proffer the opinions of another geostatician, Dr. Donald E. Myers, concerning the validity of Williams' methods; (3) the relative error rates of Dr. Williams' modeling vary depending on how they are calculated, (*id.* at 2630:22-2634:9), but it is evident that "there are standards controlling the technique's operation" about which there is substantial agreement; and (4) as noted above, the modeling tools and kriging techniques used by Dr. Williams and his associates are known and generally accepted in the geostatistical community as being reliable, at least as a means of visualizing bodies of water as yet unseen and estimating data values as yet unmeasured.

Daubert instructs that Rule 702 admissibility is governed by Fed. R. Evid. 104(a):

> Faced with a proffer of expert scientific testimony, then, the trial judge must determine at the outset, pursuant to Rule 104(a), whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue.

509 U.S. at 592-93 (footnotes omitted).[41] In this setting, "it is plain that the proponent

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[41] Rule 104(a) provides:

> "Preliminary questions concerning the qualification of a person to be a witness, the existence of a privilege, or the admissibility of evidence shall be determined by the court, subject to the provisions of subdivision (b) [pertaining to conditional admissions]. In making its determination it is not bound by the rules of evidence except those with respect to privileges." These matters should be established by a preponderance of proof. See *Bourjaily v. United States,* 483 U.S. 171, 175-176, 107 S.Ct. 2775, 2778-2779, 97 L.Ed.2d 144 (1987).

(continued...)

must make more than a *prima facie* showing . . . that a technique is reliable." *United States v. Downing*, 753 F.2d 1224, 1240 n.21 (3d Cir. 1985). "This does not mean that plaintiffs have to prove their case twice—they do not have to demonstrate to the judge by a preponderance of the evidence that the assessments of their experts are *correct*, they only have to demonstrate by a preponderance of the evidence that their opinions are reliable." *In re Paoli Railroad Yard PCB Litigation*, 35 F.3d at 744 (emphasis in original & footnote omitted).

On a preliminary basis, then, the court finds that, more likely than not, geostatistical principles and methods were applied to the facts of this case by Dr. Williams' analyses of projected plume volume, composition, and location in a sufficiently reliable fashion to be of some assistance to the trier of fact. Based upon the record now before this court, it appears Dr. Williams' projected contaminant plume gives some indication of how much above-MCL water exists and where it may be found. Defendants' experts are free to propound their own analyses and estimates using tools they choose, and their criticisms of Dr. Williams' approach go to its weight and credibility. *See* Fed. R. Evid. 104(e) ("This rule does not limit the right of a party to introduce before the jury evidence relevant to weight or credibility.")

In their current form, however, Dr. Williams' estimates of contaminant plume

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[41](...continued)
509 U.S. at 592 n.10.

volume and "buffer zone" volume are not admissible for reasons of relevance under Fed. R. Evid. 401, 402, 403 and 702, apart from the questions of Rule 702 reliability raised by the Defendants. Estimation of volumes of contaminated groundwater attributable to *non-party* sources does not advance the inquiry in this case; nor does any portion of the projected plume volume that falls within the scope of the ongoing EPA/GE remediation. And where Plaintiffs' remedy is to be measured by the cost of restoration, a "buffer zone" volume based upon a passive "containment" remedy simply does not fit.

Similar problems plague Dr. Williams' estimate of "lost safe yield."

11. Dr. Williams' Estimated "Lost Safe Yield"

Relying on his estimated plume and buffer zone volumes, Dr. Williams also prepared an estimate of "lost safe yield" from his model area of the aquifer beneath the South Valley Site. Defendants insist that Dr. Williams' current estimate of the "lost safe yield" must be excluded for being neither relevant nor reliable. First, there appears to be a lack of practical correspondence between the safe yield hypothesized by Williams for his model area at South Valley and the safe yield of the entire Middle Rio Grande Basin aquifer as borne out by existing hydrological data.[42]

The Defendants object that Dr. Williams' analyses "treat the South Valley as if it were a discrete and separate source of drinking water subject to no legal or administrative

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[42]Extending Dr. Williams' calculation of safe yield by prorating the surface area of his South Valley model area, Steven Larson computed a safe yield for the entire Middle Rio Grande Basin aquifer exceeding 4.6 *million* acre-feet per year. (*Id.* at 2984:22-2987:16 (testimony of Steven Larson).)

constraints," (Defs. Supp. Br. at 7), and fail to take into account the existing legal and administrative constraints on groundwater extraction in the Middle Rio Grande Basin, starting with the Rio Grande Compact.

Dr. Williams acknowledges that he did not evaluate the hydrology of the entire Middle Rio Grande Basin aquifer in developing his opinions,[43] and has explained that he "assumed that the safe yield of the South Valley area is equivalent to the total amount of recharge to the model area which includes boundary flows and river recharge, less the evapotranspiration and drain outflow," yielding an "average safe yield from 1992 to 2005 for the South Valley area of 19,200 acre-ft/year."[44]

Even treating his model area in isolation, however, Defendants submit that Dr. Williams' estimated "lost safe yield" fails to take into account the volume of ongoing extraction through wells within or impacting his South Valley model area:

---

[43]

> Q . . . Did you as part of your work attempt to evaluate the hydrologic conditions in the Middle Rio Grande Basin?
>
> A It wasn't part of my task, no.
>
> Q All right, sir. Now, what is the total recharge to the Middle Rio Grande Basin?
>
> A I don't know. . . . The entire Middle Rio Grande Basin? I'd have to look at the model reports. . . .

(Tr. 12/9/2003, at 2581:22-2582:5 (testimony of Dr. Williams).)

[44](Table 4 n.3, GEOSCIENCE Report, dated April 23, 2002, annexed to Declaration of Dennis E. Williams, Ph.D. in Opposition to Defendants' Various Motions to Exclude the Expert Testimony of Dr. Williams at Trial, dated August 30, 2002; Exhibit "Q" of Plaintiffs' Appendix of Exhibits in Support of Plaintiffs' Consolidated Response in Opposition to Defendants' Motion to Exclude Testimony of Plaintiffs' Expert Dennis E. Williams at Trial, filed September 16, 2002 (dkt. no. 766).)

Q And this summary of the Geoscience model water budget shows that within the area of your model, which includes the South Valley, total pumpage currently exceeds the safe yield for that area.

A No, I don't agree with that.

Q It shows that safe yield is 19,152 acre-feet a year; is that correct, Doctor?

A That's right.

Q And what is the total pumpage from that area?

A The total pumpage I think is around 20,000, if I remember.

(Tr. 12/9/2003, at 2584:16-2585:3 (testimony of Dr. Williams).)[45]

On cross-examination at the evidentiary hearing, Dr. Williams acknowledged that volume of Middle Rio Grande Basin groundwater is already being diminished by pumping to serve existing uses, primarily by the City of Albuquerque:

Q Do you know what the total pumpage is for the Middle Rio Grande Basin?

A I don't. I know the total pumping for the City of Albuquerque is over 100,000 acre-feet a year.

Q And do you agree that the City of Albuquerque and other water rights holders' pumpage from the Middle Rio Grande Basin is mining the Middle Rio Grande Basin?

A I know that from the most recent report of the City of Albuquerque, there has been a change in storage and the groundwater levels. . . . [T]he water levels are going down maybe from one to three feet

[45]Dr. Williams testified that "if you pumped the sum of these inflows minus the evapotranspiration, you could pump about 19,000 acre-feet per year within this [model area] on a long-term basis and not cause any serious long-term water level declines." (Tr. 12/9/2003, at 2519:24-2520:3; *id.* at 2520:19-23.)

per year. . . . [W]e also know that there is a future plan to replenish this area of the Albuquerque – by bringing in San Juan-Chama water, 47,000, treating part of the Rio Grande, bringing in water for artificial recharge.
. . . .

Q . . . Do you understand that the total pumpage from the Middle Rio Grande Basin annually now is decreasing the water table in that basin?

A There has been a slight decline and we took that into account in our model. But even again, this is what I term temporary surplus.

(Tr. 12/9/2003, at 2582:10-2583:15 (testimony of Dr. Williams).)

Dr. Williams' testimony suggests that existing "extractive services" account for all of his estimated "safe yield," and more, thus reducing the water level in the Middle Rio Grande Basin aquifer by one or more feet per year.

Concerning any additional "safe yield" at South Valley purportedly lost due to contamination, it appears that Dr. Williams and Mr. Johnson (relying on Williams) are labeling as "lost safe yield" a quantity of groundwater that Williams characterized as "temporary surplus":

Q Let's talk about it this way. Is it recognized from a hydrogeologic standpoint that you can pump more out of an aquifer without causing, for instance, subsidence problems, *over and above safe yield*?

A That's correct. We have a term that's called *temporary surplus*. For example, if we're in a period of drought, like we are in California, we can pull our water levels down. *We can rely on the storage to help meet our demands*. But we also then have to eventually allow the aquifer to recover or replenish. We do that by several ways. We can bring in alternative water, allow the pumps not to pump so much. We can bring in artificial recharge to replenish it. So this temporary surplus is a term that -- it is part of the best management practices, which does allow us to pull water levels down below, and for example, there have been studies shown

in New Mexico that you can deplete -- you can pull down as much as 400 feet without causing any subsidence.

Q 400 feet of what?

A 400 feet of water level.

Q And that's what I want to make sure. You know, you have talked a little bit about safe yield, that is, where pumping out equals pumping in, or recharge equals –

A Inflow, look at the bottom of the equation. Inflow is outflow over change in storage. If I need more outflow, I can pull on my change in storage. I can allow -- I can pump some brown water from storage to help meet that demand.

(Tr. 12/9/2003, at 2515:13-2516:19 (emphasis added).)[46] Counsel in turn labels Williams' "temporary surplus" as "working reserve":

Q All right. So you could have a safe yield, which is basically an equalization of what's going in and what's coming out. You can have a working reserve that is where you can actually extract more in a given year or series of years for whatever the purposes you need it for drinking water?

A That's right.

Q Maybe it's drought?

A Well, or also maybe its pulling the water levels down, like we do a lot in anticipation of large-scale artificial recharge programs. . . .

. . . .

Q The concept of being able to take more than just the safe yield – is that also recognized in hydrogeology as a scientific principle that is

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[46]Dr. Williams also defined a "safe minimum yield" as "a long term target goal which you probably wouldn't want to ever go below," representing the "volume of water below which you will potentially cause subsidence." (*Id.* at 2516:13-2517:2.) Thus, the "safe minimum yield" would serve as the lower limit of Dr. Williams' "temporary surplus." (*See also* Tr. 12/10/2003 PM, at 2898:17-2899:8 (testimony of Mr. Johnson).)

applied day in, day out?

> A Yes. It's a best management practice, but keep in mind you have to eventually have programs for recharging or allowing the water levels to recover. *You can't just keep draining the aquifer.*

(*Id.* at 2517:9-2518:12 (emphasis added).)

Dr. Williams' testimony lends support to Plaintiffs' view that there exists a volume of *in situ* groundwater in the Middle Rio Grande Basin aquifer that would be available for future extraction as "working reserve," "drought reserve," or "temporary surplus"—however Plaintiffs may choose to label it—and that the future use of at least a portion of that "temporary surplus" volume may be impaired by chemical contamination.[47] However, the volume thus impaired does not equate with "loss of safe yield."

> Okay. How we calculated the loss of safe yield? The 11,000-model acre area, which has a safe yield of about 19,000 – we looked at the area, the footprint of the contaminant plume including the buffer zone, the MCL plume, and we did the ratio of the area of that water divided by the total model area times [th]is 19,000.

(*Id.* at 2520:24-2521:5.)

Calculated in this fashion, Dr. Williams' estimate of "lost safe yield" at South Valley does not tend "to make the existence of" a volume of unappropriated groundwater that the State could otherwise have made available for appropriation from the aquifer's

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[47]Mr. Johnson's estimated "operating yield," based upon periodic fluctuations in the water table, likewise appears to be drawing upon Williams' "temporary surplus" rather than equalizing with the actual annual recharge to the aquifer. (Tr. 12/10/2003 AM, at 2738:1-2747:3; Tr. 12/10/2003 PM, at 2860:13-2861:19, 2891:18-2899:8 (testimony of Mr. Johnson). *See* Tr. 12/11/2003 AM, at 3050:12-3051:6 (testimony of Mr. Grisak) ("the operational yield is a short-term issue that, if you take the water out of the basin, out of storage, you have to put it back."); Tr. 12/10/2003 PM, at 2981:10-2984:20 (testimony of Mr. Larson).)

safe yield [48] any "more probable or less probable than it would be without the evidence." Fed. R. Evid. 401. Dr. Williams acknowledges that existing pumping from the Middle Rio Grande Basin is already drawing on what he calls "temporary surplus," thus reducing the total volume of groundwater over time:

SUMMARY OF GEOSCIENCE MODEL WATER BUDGET[49]

	Terms	1992-2005 Average [acre-ft/yr]
	Inflow	
[1]	Net General Head Boundary Inflow	8,446
[2]	Net River Recharge	11,129
[3]	Pump and Treat Systems Injection	992
	Total Inflow	**20,567**
	Outflow	
[4]	Ground Water Pumping	21,351
[5]	Pump and Treat Systems Extraction	992
[6]	Evapotranspiration	423
[7]	Drain Outflow	0
	Total Outflow	**22,766**
	Change in Ground Water Storage	**-2,199**
	Safe Yield = [1] + [2] - [6] - [7]	**19,152**

Yet his estimate as to "lost safe yield" does not appear to take this existing burden on the resource into account, and in fact treats part of the volume of current pumping (21,351 acre-ft/yr.) as extractive services "lost" in direct proportion to the surface area of his

[48] Dr. Williams did not evaluate any impairment or loss of groundwater use by existing appropriators (water rights holders) in making his estimates. (Tr. 12/9/2003, at 2556:2-2559:2 (testimony of Dr. Williams).) Thus, his estimate necessarily bears upon *unappropriated* groundwater that could otherwise be made available for use by new appropriators. (*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 46-50.)

[49] (Williams 12/9/2003 Evidentiary Hearing Slide Presentation.)

projected plume.[50]

Whether Dr. Williams' estimate of the volume of "lost safe yield" will be helpful to the trier of fact on the ultimate issue of the injury to Plaintiffs' interests in South Valley groundwater (*viz.*, lost "extractive services") also depends upon legal and administrative considerations beyond the scope of Williams' analysis. From his proffered testimony, it does not appear that Plaintiffs have asked Dr. Williams to take into consideration any restrictions on further extraction of groundwater from the Middle Rio Grande Basin aquifer resulting from the State of New Mexico's obligations under the Rio Grande Compact. Dr. Williams testified that he had not taken legal restrictions into account:

> Q Now, among other things, Doctor, that you did not do is that you did not consider whether legal or administrative constraints limit or prohibit the use of allegedly lost groundwater, regardless of the level of contamination.
>
> A I didn't look at that, no.
>
> Q So for example, you didn't consider the existence of any restrictions that would otherwise prevent or limit the pumping of the allegedly lost groundwater in the South Valley.
>
> A You mean legal or otherwise? I did not look at that, no.

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[50](*Id.*) According to Dr. Williams' data, the *existing* groundwater extraction from his model area already exceeds the total "safe yield" for his entire model area by 2,199 acre-feet/year. If as Dr. Williams suggests, "Loss of Safe Yield Due to Ground Water Contamination" equals

(Area of Plume ÷ Area of Model Area (11,157 acres) x 19,200 acre-feet/year),

then the volume of "lost safe yield" he attributes to his estimated plume volume is nevertheless being extracted by current pumping, with *no net loss in the volume of water made available for appropriation.*

Dr. Williams' inclusion of water volumes bearing contaminants attributable to Univar in his estimated plume volume also enlarges the plume's "footprint" beyond that fairly attributable to the Defendants' conduct, thus overstating the volume "lost" for purposes of this case.

. . . .

Q . . . In other words, it makes no difference to you that the water which you say is allegedly lost could, in fact, not have been pumped anyway because of some other legal constraint such as the Rio Grande Compact.

A No, I didn't evaluate the Rio Grande Compact in this context.

(Tr. 12/9/2004, at 2562:20-2563:18 (testimony of Dr. Williams).)

Legal obligations under instruments such as the Rio Grande Compact cannot determine the hydrological "safe yield" of an aquifer any more than they can dictate the annual flow of surface streams, or for that matter, the amount of annual rainfall that ultimately determines both safe yield and annual streamflows. These are not legislative determinations; they are matters of hydrology, geology, and ultimately, meteorology.

In contrast, legal obligations under the Rio Grande Compact may directly impact the amount of groundwater or surface streamflow that *may be made available for further appropriation*. Given the interdependent hydrology and finite nature of surface and groundwater resources, the hydrological "safe yield" of the aquifer by itself cannot determine availability for appropriation where existing groundwater volumes must remain in place to support stream flows. This is essentially the situation that Defendants contend exists in the Middle Rio Grande Basin under the Rio Grande Compact.

Given the Plaintiffs' acknowledgment in this case as well as other judicial proceedings that the waters of the Middle Rio Grande Basin are already fully appropriated, Dr. Williams' estimates as to the aquifer's "lost safe yield"—hydrologically

accurate or not—prove to be immaterial the ultimate issue whether the groundwater beneath the South Valley Site was, is, or could be made *available for appropriation*, and has been lost to further appropriation as drinking water because of the contamination.

From an administrative standpoint, availability of Middle Rio Grande Basin groundwater for further appropriation beyond existing rights has in this instance been determined by the State Engineer. (*See* Memorandum for Partial Summary Judgment Seeking Dismissal of Plaintiffs' Alleged Lost Services Claims Under CERCLA and Lost Use Claims at Common Law, filed July 10, 2002 (dkt. no. 612), at 3-6 ¶¶ 1-5.)[51]

Since November 29, 1956, when the State Engineer first declared the Rio Grande Underground Water Basin as "an underground water basin . . . subject to the New Mexico statutes, and the rules and regulations of the State Engineer,"[52] the State Engineer has consistently treated the Middle Rio Grande Basin aquifer—including the groundwater beneath the South Valley Site—as a single administrative unit, and has managed the Basin's interrelated surface and groundwater to maintain stream flows in compliance with the terms of the Rio Grande Compact. (*See* Affidavit of Dennis R. Cooper in Support of

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[51]Recalling the exceptions to the NMWQCC discharge and abatement regulations providing that those NMWCQQ standards do not govern "use," NMAC §§ 20.6.2.3101(C), 20.6.2.4101(C), Plaintiffs' counsel represented that these provisions were included in those regulations to ensure the State Engineer's continuing control over whether water is made available for use through appropriation. (*See* Transcript of Hearing, dated February 5, 2003, at 1873:8-12 (Mr. Garber) ("The State Engineer is a member of the Water Quality Control Commission, and wanted to ensure that the adoption of these regulations did not impair in any way with the engineer's ability to allocate the use of water.").)

[52](Order, dated November 29, 1956, Attachment 1 to the Affidavit of Dennis R. Cooper in Support of Motion for Partial Summary Judgment, dated July 8, 2002, annexed as Exh. A to Motion and Memorandum for Partial Summary Judgment Seeking Dismissal of Plaintiffs' Alleged Lost Services Claims Under CERCLA and Lost Use Claims at Common Law, filed July 10, 2002 (dkt. no. 612).)

Motion for Partial Summary Judgment, dated July 8, 2002, annexed as Exh. A to Motion and Memorandum for Partial Summary Judgment Seeking Dismissal of Plaintiffs' Alleged Lost Services Claims Under CERCLA and Lost Use Claims at Common Law, filed July 10, 2002 (dkt. no. 612), and attachments annexed thereto.)

In September 2000, the State Engineer issued *Middle Rio Grande Administrative Guidelines for Review of Water Rights Applications.* (*See id.* at Attachment 3.)

> The Guidelines recognize that the surface flow of the Rio Grande is fully appropriated, that surface and ground waters in the Rio Grande Basin are hydrologically interconnected, and that new ground water permits will not be issued in the Basin, including the South Valley area, unless the applicant acquires and retires an existing surface water right in an amount equal to the river depletion that would result from the proposed ground water appropriation.

(*Id.* at 4 ¶ 3.) According to the State Engineer, then, groundwater is made available for further appropriation only through the acquisition or surrender of equivalent surface water rights already in existence.

Dr. Williams' "lost safe yield" estimate does not take these legal and administrative constraints into account. (*See* Tr. 12/9/2003, at 2562:20-2563:23 (testimony of Dr. Williams).) For this reason as well, therefore, Dr. Williams' estimates of "lost safe yield" at South Valley cannot be helpful to the trier of fact under Rule 702 on the issue of lost "extractive services," and do not tend "to make the existence of" the fact of a volume of unappropriated groundwater that the State could otherwise have made available for appropriation from the aquifer's safe yield any "more probable or less

probable than it would be without the evidence." Fed. R. Evid. 401. This *availability* determination involves the groundwater volume of the entire aquifer treated as a unit, and cannot be localized to a portion of the aquifer having no ascertainable geohydrological boundary distinguishing it from the rest of the Middle Rio Grande Basin.[53]

Dr. Williams' South Valley "lost safe yield" estimates thus are not relevant to that question, and "[e]vidence which is not relevant is not admissible," Fed. R. Evid. 402; nor will it "assist the trier of fact to understand the evidence or to determine a fact in issue" for purposes of Fed. R. Evid. 702, and must be excluded on that ground as well.

12. Summary

For reasons of relevance more than Rule 702 reliability, the proffered testimony of Dr. Dennis E. Williams concerning the estimated volume, location, content and movement of the plume(s) of contaminants found beneath the South Valley Site,[54] is not

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[53]The State's interest in groundwater is thus delineated: "The water of underground streams, channels, artesian basins, reservoirs or lakes, *having readily ascertainable boundaries*, are hereby declared to be public waters and to belong to the public and to be subject to appropriation for beneficial use." N. M. Stat. Ann. § 72-12-1 (Cum. Supp. 2002) (emphasis added). It is the groundwater within the ascertainable boundaries of the Middle Rio Grande Basin that is thus made available for appropriation after the State Engineer's 1956 declaration.

Plaintiffs assert that "[t]he concept of safe yield is not restricted to large ground water basins and may be applied to ground water reservoirs which includes wellfields [sic], and portions of larger regional ground water basins." (Pltfs' Joint Resp. (Williams) at 12.) Nevertheless, under the State Engineer's administrative system, *availablility* for appropriation cannot be measured by localized "safe yield" estimates, particularly where, as Dr. Williams acknowledges, much of the recharge to the portion of the aquifer underlying South Valley comes from the closely regulated flow of the Rio Grande River. (*See* Tr. 12/9/2003, at 2577:17-2579:12.)

[54]Given the identification of contaminants traceable to the Univar site or attributable to one or another of the Defendants, there may be more than one definable "plume" of contaminated water beneath the South Valley Site.

(continued...)

admissible in its current form at the first phase trial on injury and damages. His opinions concerning the estimated volumes of "lost safe yield" due to above-MCl chemical contamination and of a "buffer zone" intended to retard the migration of that contamination are not admissible for want of relevance and because they cannot "assist the trier of fact to understand evidence or to determine a fact in issue" in this case, as Rule 702 requires. The Defendants' motions exclude Dr. Williams' testimony shall be granted to the extent and for the reasons explained above.

C. Dr. Donald E. Myers

Plaintiffs also proffered the testimony of Dr. Donald E. Myers, Professor Emeritus of Mathematics at the University of Arizona,[55] as an expert on geostatistics, spatial interpolation (including "kriging"), and statistical analysis. (Tr. 1/7/2004 PM, at 3746:22-3750:8, 3755:13-3761:12 (testimony of Dr. Myers).) Dr. Myers was designated as a rebuttal witness and testified at the January 7, 2004 evidentiary hearing. He has reviewed

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[54](...continued)

Q. . . . Dr. Williams made an important decision in this case that there was one plume. Do you understand that?

A. Yes, I understand.

. . . .

Q. Dr. Williams' Kriging approach was reasonable if you assume that there was one plume rather than two or more plumes in the South Valley; that's true, isn't it?

A. I think you would have to be a little more detailed. I think if, in fact, there are several plumes, then you would have to ask whether or not you can treat it as one data set or you have to treat it as several data sets.

(Tr. 1/7/2004 PM, at 3812:13-3813:4 (testimony of Dr. Myers).)

[55]Ph.D., mathematics, University of Illinois-Urbana, 1960; Assistant Professor, Associate Professor and Professor, University of Arizona, 1960-1998. Dr. Myers also holds a joint appointment in hydrology.

and commented upon the geostatistical work of Dr. Williams and his associates, as well as the reports prepared by several of the Defendants' experts criticizing Dr. Williams' work. (*Id.* at 3761:18-23.)

Dr. Myers presented a thorough, if somewhat esoteric evaluation of Williams' kriging exercises and response to Williams' critics. (*Id.* at 3762:6-3796:20.) He did not examine GEOSCIENCE's groundwater flow and solute transport modeling, and offered no opinion concerning the accuracy of Williams' projected plume volume. (*Id.* at 3797:6-3805:13, 3810:18-3811:23.)

Dr. Myers is clearly qualified to offer expert testimony concerning statistical interpolation, and the methods he testified to appear to be reliable and widely accepted as estimation tools. The exclusion of Dr. Williams' plume volume estimates obviates the need for rebuttal testimony concerning criticisms of those estimates. To the extent that "kriged" values are proffered at all, however, Dr. Myers' testimony as to geostatistical methods may assist the trier of fact in understanding the information presented.

D. Dr. John W. Hawley

Though not originally calendared for the Rule 702 evidentiary hearing, the Plaintiffs asked that another of their experts, Dr. John W. Hawley,[56] be heard on the hydrogeology and administrative history of the Middle Rio Grande Basin, particularly the

[56]B.A., 1954, geology, Hanover College,, Ph.D., 1962, geology, University of Illinois-Urbana; Emeritus Senior Environmental Geologist, New Mexico Bureau of Geology & Mineral Resources, New Mexico Institute of Mining & Technology.

portion underlying the South Valley Site. Dr. Hawley is a well-known New Mexico hydrologist with years of experience and impressive professional credentials.

For the most part, Dr. Hawley's opinions concern the intrinsic merit of the South Valley portion of the Middle Rio Grande aquifer as a storage reservoir and source of supply. (*See* Tr. 1/7/2004 PM, at 3824:24-3906:17.)[57] These opinions largely bear upon Plaintiffs' claim for the lost storage value of the portion of the aquifer beneath the South Valley Site, and this court has determined that Plaintiffs lack the requisite property interest that would confer standing to pursue those claims in this action. (*See*

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[57]Dr. Hawley has often been quoted for his characterization of the South Valley as the "crown jewel" of the Middle Rio Grande Basin aquifer:

> Q. . . . Why is this so special, why is this something that you call the crown jewel?
>
> . . . .
>
> A. These . . . recharge windows are unique in that they're places where the river is close to or right against . . . the side of the valley.
>
> . . . .
>
> In reference to the San Jose recharge window and associated Rio Grande recharge corridor, it is one of only two places in the Albuquerque metropolitan area where the major aquifer unit, namely, the Upper Santa Fe group, . . . is well connected with the linked shallow geohydrologic system formed by the Rio Grande itself, the riverside drains, secondary drains, irrigation canal networks, and buried alluvial deposits of the earlier river. . . .
>
> [T]his is the only area where the structure and texture of the Upper Santa Fe group provide a very efficient connection between the inner river valley fill shallow aquifer system . . . and the main centers of groundwater production in the Albuquerque East Heights district and . . . the San Jose area is hydrogeologically and hydraulically well connected with the Miles and Burton wellfield area because the Santa Fe group sand dominated sedimentary sequence is tilted in the direction of groundwater flow. . . .
>
> . . . .
>
> But that area has – would have had all kinds of potential for resolving all these problems we have in terms of how do we keep the river wet, how do we keep the . . . cone of depression from sinking more, and that kind of thing.
>
> . . . .
>
> But right there is where we've got the water, we've got the geology, we've got the structure.

(*Id.* at 3844:2-4, 3845:2-5, 3845:13-22, 3847:14-3848:1, 3854:23-3855:2, 3855:12-13.)

Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 30.)

Dr. Hawley appears to be a very knowledgeable person with many years of experience in this area, a well-known and highly respected colleague and mentor. The question presented here, however, is whether his testimony can assist the trier of fact in finding facts and deciding issues. Dr. Hawley's description of the Middle Rio Grande Basin aquifer and its relationship to the Rio Grande River may provide relevant background for the issues to be decided at the first phase of trial, but beyond that, his proffered opinions largely appear to be irrelevant to the triable issues remaining in this case.

E. The Defendants' Experts

As noted above, this court has also heard proffered expert testimony from several of the Defendants' experts, including Steven P. Larson, Gerald E. Grisak, Matthew Davis, Emlen Hall, John A. Connor, John Billiard, Phillip Soice, Dennis Cooper, Theodore Tomasi, and William H. DesVousges. Several have expertise in hydrology and geohydrology, or engineering; others are schooled in environmental economics or law.

The court has reviewed the knowledge, training and experience of each of these witnesses as proffered at the hearing, and is satisfied that each is qualified to testify as an expert concerning his designated subject matter.

At this point, however, the court need not further explore the admissibility of the testimony of the economists, Ted Tomasi, who proffered testimony in response to the

damages valuations prepared by Dr. Brookshire and Mr. Johnson. As neither Dr. Brookshire nor Mr. Johnson will be testifying on these subjects at the first phase of trial, testimony responding to or criticizing their analyses likewise seems unnecessary.

1. The Hydrologists:

a. Steven P. Larson

Steven P. Larson, a groundwater hydrologist[58] with experience in contamination problems and computer modeling, testified concerning his review of the work of Dr. Williams and his associates and that of Stetson Engineers (testified to by Stephen Johnson), as well as the available technical documents and databases pertaining to the contamination problem beneath the South Valley Site. (Tr. 12/10/2003 PM, at 2899:21-2902:15 (testimony of Mr. Larson).)

Mr. Larson offered a series of criticisms of the Williams and Stetson/Johnson analyses, *viz.*, that they failed to identify or evaluate any actual loss of use of groundwater from the Middle Rio Grande Basin, failed to consider wellhead treatment as an alternative to passive containment of the contaminants, and failed to take into account the existing administrative and practical constraints on further groundwater appropriation, including the problem of naturally occurring arsenic contamination. Moreover, Larson opined that

[58]Mr. Larson holds a Bachelor's Degree and Master's Degree in civil engineering from the University of Minnesota with emphases in hydrology and hydraulics and a minor in computer science, and has been certified as a grounwater hydrologist by the American Institute of Hydrology. He has published several articles in peer-reviewed journals discussing groundwater hydrology and computer modeling. (Tr. 12/10/2003 PM, at 2905:5-2906:11.)

Dr. Williams' groundwater flow and solute transport modeling failed to predict with reliable accuracy the extent and location of "above-MCL" groundwater contamination, and "that there are no bases for the calculations presented by Dr. Williams and Mr. Johnson with respect to their calculations of safe yield and operating yield and . . . for their conclusions about the lost volumes." (*Id.* at 2903:2-2904:24, 2912:21-2925:4.) Indeed, Larson testified that defects in Dr. Williams' modeling account for 100 percent of the predicted "above-MCL" plume volume after the year 2016. (*Id.* at 2946:14-22.)[59]

Mr. Larson also questioned Dr. Williams' "safe yield" estimates, noting that Williams' model equates groundwater flow through his model area with "recharge" to that area, when in fact the flow originates elsewhere and results from significant pumping in or near the model area. (*Id.* at 2977:10-2980:21.)

> Q. Does the amount of water flowing into the Geoscience model domain have any relation to the safe yield of the Middle Rio Grande Basin?
>
> A. No, it does not.

(*Id.* at 2980:22-25.) Larson testified that Williams' prorated "safe yield" for his model area may be extended to the entire basin, resulting in a total "safe yield" of over 4.6 *million* acre-feet per year, which does not match experience in actual practice. (*Id.* at 2984:23-2987:16.)

As to Mr. Johnson's estimates of groundwater volumes lost to beneficial use as

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[59] According to Mr. Larson, apart from software errors and the inclusion of Univar contaminants, Dr. Williams' modeling overpredicts the size of above-MCL plumes because of errors in the kriging done by GEOSCIENCE. (*Id.* at 2948:6-2954:6, 2954:16-2958:20.)

drinking water, Mr. Larson opined that among other things, it was error to rely upon the State Engineer's "press release" zone[60] to define the volume of impacted groundwater because it "does not delineate an area of contamination" and "is not an area in which pumping is prohibited." (*Id.* at 2970:3-2971:3; *accord* Tr. 12/11/2003 AM at 3084:3-3086:12 (testimony of Mr. Grisak); Tr. 12/11/2003 PM, at 3430:7-3436:11 (testimony of Mr. Connor).)[61] Mr. Johnson made no independent effort to estimate to volume of above-MCL water, and according to Larson, Stetson/Johnson's opinion concerning the existence of deeper contamination is not supported by the existing well sampling data. (*Id.* at 2971:12-2972:25, 2991:20-2992:8, 3029:17-3031:4.)[62]

Mr. Larson did not formulate his own "safe yield" or contaminant plume volume estimates, (*id.* at 2989:17-2990:3), or construct his own groundwater flow model. (*Id.* at 3016:1-3017:5.) The court need not examine the reliability of Larson's method or application in making estimates or constructing models where he has done neither. As his analysis is grounded in the review of the work of Williams and Stetson/Johnson, the exclusion of the opinions of Williams and Johnson at this point renders Larson's critique largely irrelevant to the issues awaiting the first phase of trial. However, his analysis and

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[60](*See* Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 48 n.59.)

[61]In terms of loss of use, the 1988 press release apparently resulted in "an inability to make use of screens in a particular level in the San Jose well field in the area of the contamination," but did not prohibit pumping altogether. (Transcript of Hearing, dated January 7, 2004 A.M. Session, at 3723:10-12 (testimony of Dr. Tomasi).)

[62]Mr. Larson also criticized Johnson's "replacement storage reservoir" damages estimate, asserting that the storage capacity of the existing acquifer remains available today. (*Id.* at 2973:1-2977:9.)

understanding of the compiled well sample data may yet have some bearing upon those issues, particularly with reference to the Plaintiffs' "deep, deep plume" theory.

b. Gerald E. Grisak

Similarly, Gerald Grisak was proffered as a geohydrologist with knowledge, training and experience in groundwater modeling and contamination assessments, in "the study of the fate and transport of contaminants in groundwater systems." (Tr. 12/11/2003 AM, at 3036:21-3037:21 (testimony of Mr. Grisak).)[63] He also works on the construction, operation and maintenance of groundwater treatment systems. (*Id.* at 3038:22-3041:8.)

Mr. Grisak testified as to the hydrological characteristics of the Middle Rio Grande Basin (*id.* at 3041:10-3044:3, 3045:15-3049:25, 3135:4-3136:21), and offered his own evaluation of Dr. Williams' modeling, comparing Williams' projected contaminant plume against one Grisak outlined in five layers using linear interpolation and hand contouring of well sample data. (*Id.* at 3054:5-3066:18, 3098:17-3109:18.) He also reviewed Williams' histogram error analysis, comparing predicted vs. actual data, and performed an "R-squared" error analysis. (*Id.* at 3067:18-3081:6, 3122:10-3131:7.) He insisted that "safe yield" is a basin-wide concept (*id.* at 3046:5-3051:6, 3091:1-17, 3138:3-3140:21), that a change in point of diversion does not represent a loss of safe yield (*id.* at 3047:17-

[63]Mr. Grisak holds a Bachelor's Degree in geology from the University of Alberta, 1971, and a Master's Degree in hydrogeology from the University of Waterloo, 1973. He is certified as a professional geologist and hydrologist, and has served as Senior Hydrologist and Vice President of INTERA, Inc. since 1981.

22, 3140:22-3142:10), and disputed Plaintiffs' assertion that the volatile organic compounds at issue are sinking into the aquifer faster than the vertical flow of the groundwater in which they are dissolved. (*Id.* at 3083:1-3084:1, 3133:15-3135:3.) He opined that many of the above-MCL samples obtained from deep wells in the early 1990s were the result of the installation methods used, rather than evidence of a deeper contaminant plume. (Tr. 12/11/2003 AM, at 3082:8-22, 3109:19-3122:9)

Mr. Grisak also compared the South Valley Site to the San Gabriel Valley Site discussed by Mr. Johnson, observing that the San Gabriel site is many times larger, with a contaminant plume of about thirty square miles, in contrast to approximately 0.3 square miles at South Valley. (*Id.* at 3086:20-3088:11.)

Finally, Mr. Grisak prepared three wellhead treatment scenarios for the South Valley Site, and indicated that using a pump-and-treat system like that implemented by General Electric would enable South Valley groundwater to be piped directly into the City of Albuquerque's water distribution system. (*Id.* at 3088:17-3089:16.)

c. Dr. Matthew Davis

Dr. Matthew Davis, a professor of hydrogeology at the University of New Hampshire,[64] a teacher of hydrology, groundwater modeling and geostatistics, and a

[64]B.S., 1987, earth science and geophysics, Montana State University; M.S., 1990, hydrology, New Mexico Institute of Mining and Technology; Ph.D., 1994, hydrogeology, New Mexico Institute of Mining and Technology. (Tr. 12/11/2003 AM, at 3143:18-3144:5 (testimony of Dr. Davis); "Matt Davis Resume & Demonstratives," submitted December 11, 2003.)

student of the Middle Rio Grande Basin,[65] proffered opinions concerning the recharge characteristics of the Middle Rio Grande Basin aquifer in the vicinity of the South Valley Site,[66] and Dr. Williams' use of geological information and accepted techniques in his modeling. Dr. Davis concluded that the portion of the aquifer in the vicinity of the South Valley Site is not highly productive, highly transmissive or easily recharged, in large part because of greater deposits of silt and clay found there. (Tr. 12/11/2003 PM, at 3154:8-3167:5.)[67] He also disputed Williams' and Johnson's "safe yield" analyses; the safe yield of the South Valley cannot be evaluated in isolation from the rest of the aquifer, particularly in light of the decline in water level in the basin over the last 40 years. (*Id.* at 3169:1-3171:16.) Davis also criticized Williams' use of "telescopic mesh refinement" in constructing his local South Valley model using the larger regional model produced by the United States Geological Survey to set his boundary conditions. According to Davis, Williams overstates the inflow into his model area, rendering the model's predictions inaccurate. (*Id.* at 3171:17-3184:7.)

Dr. Davis' testimony is descriptive of the aquifer, a detailing of what is there and how it appears to behave. Like Dr. Hawley, Dr. Davis may assist the trier of fact by

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[65](*Id.* at 3145:2-3146:4 (research papers and journal publications re: Middle Rio Grande Basin).)

[66]In this regard, Dr. Davis was called upon to rebut the opinion of Plaintiffs' expert Dr. John Hawley, that the South Valley area is the "crown jewel" of the Middle Rio Grande Basin. (*Id.* at 3152:11-15, 3153:4-8, 3154:8-3155:1.)

[67]Dr. Davis also concluded that the South Valley was not a likely candidate for artificial recharge proposed by Mr. Johnson. (*Id.* at 3167:6-3168:24.)

providings background concerning its geohydrology and groundwater flow in the vicinity of the South Valley Site. At this point, the question of the value of the aquifer beneath the South Valley as a storage reservoir is not before the court, and opinions on that subject are simply not relevant to the issues that remain. Similarly, Dr. Davis need not respond to "lost safe yield" estimates by Dr. Williams and Mr. Johnson because at this point, those estimates have been excluded from trial. The same is true as to Dr. Williams' current modeling of his predicted contaminant plumes.

2. The Civil Engineers:

a. John A. Connor

John A. Connor, a civil engineer with specialized knowledge of groundwater hydrology and modeling tools, chemical fate and transport, and ecological risk assessment, [68] examined Dr. Williams' groundwater flow and solute transport modeling and proffered opinions concerning its reliability. In an animated and loquacious presentation extending into the evening, Mr. Connor opined as to the "three essentials of modeling":

> [T]he first is that the initial plume must match the actual plume. The second is that the simulated model trend over time should match the actual model trend over time in terms of the size of the plume and the concentration of the plume. And finally the third is that the future extrapolation time period should be less than or equal to the past calibration

[68] B.A., 1978, English with distinction, Stanford University, M.S., 1979, civil engineering, Stanford University; Mr. Connor is a registered professional engineer, a diplomate of the American Academy of Environmental Engineers, and President and Geotechnical Engineer for Groundwater Services, Inc. He has published a number of journal articles and has taught groundwater hydrology at the University of Houston.

time period.

(Tr. 12/11/2003 PM, at 3380:10-17 (testimony of Mr. Connor) (citing ASTM D5447-93).) In Mr. Connor's view, Dr. Williams' modeling is found wanting in each of these respects. (*See id.* at 3382:1-3420:12.) He opined that Williams' model "gives an incorrect characterization of the size of the plume and is also structured so as to overpredict the migration and persistence of that plume over time," thus predicting "too big of a plume, too fast of a plume, and too persistent of a plume . . . ." (*Id.* at 3445:14-21.)[69]

Mr. Connor discussed Williams' "buffer zone" analysis, recounting his own tests of Williams groundwater flow and solute transport modeling, and the placement of five hypothetical wells within the projected "buffer zone," each of which could run for twenty years without pumping "above-MCL" water—according to Williams' own solute transport models. (*Id.* at 3420:14-3426:11.)

Mr. Connor also opined concerning the efficacy of wellhead treatment in restoring South Valley groundwater to drinkable quality. (*Id.* at 3428:2-3430:5.)

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[69]Among Mr. Connor's more intriguing suggestions is his assertion that

> there's so much data at this site we don't need to model it. We use models to predict things we don't know. We know where the plume is here. There are over 615 wells, 6,520 groundwater samples, 217,000 laboratory analyses, over 1,100 soil borings have been drilled.
>
> This is one of the most intensely investigated sites in this country, in the world. It's very well understood. You don't need a model when you know what's going on.

(*Id.* at 3446:4-13.)

b. John Billiard

John Billiard, a civil engineer who has played a key role in the design and implementation of the current Plant83/General Electric remedial system,[70] testified about the operation and effectiveness of that system in capturing and removing groundwater contaminants, and about the efficacy of wellhead treatment in removing volatile organic chemicals from groundwater and rendering it potable once again. He also expressed an opinion about the size of the contaminant plume beneath the South Valley Site. (Transcript of Hearing, dated December 12, 2003 ("Tr. 12/12/2003"), at 3484:16-24.)

The goals of the Plant 83/General Electric system include the capture and containment of groundwater exceeding standards known as "applicable or relevant and appropriate requirements" (ARARs), treatment of that groundwater to a level at or below the ARAR standard, recharge of that treated water into the deep-zone aquifer, together with monitoring to verify that the goals are being achieved. (*Id.* at 3485:3-12.) Mr. Billiard testified in detail about the design and operation of that system, and as to whether the system is meeting its goals. (*Id.* at 3485:13-3496:13.) From March 1996 through October 2003, over 2.8 billion gallons of water had been treated by the Plant 83/General Electric, almost all of which has been reinjected into the aquifer. (*Id.* 3496:14-3497:16.) The efficacy of the system is monitored according to a revised performance and

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[70]B.S., civil engineering, University of Colorado, Denver, M.S., civil engineering, University of Colorado, Denver, M.B.A., University of Colorado, Denver. Mr. Billiard is a registered professional engineer in Colorado, and has served as lead designer, construction manager, and program manager of the Plant 83/General Electric remedial system at the South Valley Site.

compliance monitoring plan and a series of periodic reports are routinely generated 3497:17-3500:24.) And "what does the data show regarding the treatment of VOC-contaminated water?"

> A The data shows very clearly that we have treated the contaminated water to below ARARs in every case, and in nearly every case, nondetect levels.
>
> Q And similarly, in summary, what does the data show regarding plume capture?
>
> A The data shows that the olume has been captured and contained since the time the treatment system has been turned on, and continues today.
>
> Q And what does the data show regarding the volume of the plume?
>
> A That the volume of the plume has been shrinking significantly since this system has been turned on.

(*Id.* at 3501:2-18; *see* 3501:19-3533:25.) Testing by the New Mexico Environment Department (NMED) likewise found no above-MCL or above-ARAR samples, even when analyzing for "a much wider, broader list of contaminants." (*Id.* at 3512:7-15.) The data indicates that in terms of depth, "there is an effect of the extraction and injection system below 4,600" feet above sea level. (*Id.* at 3567:2-3; *see id.* at 3588:13-3590-2.)

Mr. Billiard also made an estimate of the current volume of the above-MCL or above-ARAR plume beneath the South Valley Site of approximately 696 acre-feet. (*Id.* at 3535:25-3536:24.) He rejected Plaintiffs' postulate of the existence of a plume around the West Bay 4 well; above-ARAR samples collected there in 1994 were

attributed to an artifact of the construction of the well. (*Id.* at 3525:21-3531:3, 3569:1-3571:19, 3572:4-3578:20.)

Mr. Billiard testified concerning wellhead treatment at several locations, noting that it had been successful in removing volatile organic compounds from groundwater. 3540:3-3542:15.) Billiard also pointed to his own remedial system as proof that wellhead treatment could work successfully at South Valley: "I can go out there right now and turn the spigot, and I will get water that's ND [contaminants as "non-detect" levels]. And I can do that yesterday, I can do that today, and I'll be able to do that tomorrow." (*Id.* at 3543:13-16; *see id.* at 3579:1-24.) He also estimated the costs of such a system. (*Id.* at 3579:25-3584:3, 3590:19-3592:16.)

c. Phillip Soice

Phillip Soice, a civil engineer trained in the law,[71] testified as to whether the State of New Mexico holds any existing water rights affecting South Valley groundwater; whether the State has been precluded from making water available for appropriation by reason of the contamination underlying the South Valley Site; and whether the City of Albuquerque's exercise of its own water rights has been impaired by that contamination. (Tr. 12/12/2003, at 3596:14-3598:2 (testimony of Mr. Soice).) In each instance, Mr. Soice concluded that the answer was "no." (*Id.*) He found no records at the State

[71] B.S., 1971, civil engineering, University of Kansas, M.S., 1972, water resources engineering, University of Kansas, J.D., 1979, University of Kansas; Mr. Soice is a registered professional engineer in New Mexico and Colorado, a member of the New Mexico Bar, and President of Southwest Water Consultants, Inc.

Engineer's office indicating State ownership of any pertinent water rights (*Id.* at 3598:3-3600:10.) He relied upon the State Engineer's administrative guidelines, issued in 2000, limiting new appropriation of water from the Middle Rio Grande Administrative Area. (*Id.* at 3600:11-3603:24.) He also looked to the City of Albuquerque's existing water rights, compared them with the quantities of groundwater reportedly pumped by the city, and observed "pretty normal growth" over several years, with no apparent decline in total usage due to the closure of the San Jose 6 Well. (*Id.* at 3604:1-3608:2, 3617:9-3620:24.)[72]

Mr. Soice also opined that the State Engineer's 1988 press release[73] did not prohibit appropriation or diversion of any quantity of water from the South Valley "press release" area. (*Id.* at 3608:3-3614:13, 3621:1-3624:9.) He contrasted the 1988 release with a July 2003 regulation prohibiting anyone "to appropriate new surface water or groundwater" within an area surrounding the Fruit Avenue Superfund Site," located across the street from this court's Albuquerque courthouse facility. (*Id.* at 3612:5-3614:13.)

Finally, Mr. Soice related his experience in Santa Fe with the use of wellhead treatment to remove contaminants from water pumped by the Baca Street Well; since 1989, that well has supplied 800 million gallons of treated water into the Santa Fe

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[72]Mr. Soice served as managing director of the Santa Fe municipal water system from 1986-1992, and has some direct experience with municipal groundwater usage. (*Id.* at 3595:21-3596:2.)

[73]*See* n. 60, *supra*, and accompanying text.

municipal water system. (*Id.* at 3614:14-3616:17.)

d. Dennis R. Cooper

Mr. Cooper is an engineer with years of experience working with the Office of the State Engineer,[74] now serving as a consulting engineer assisting those who would apply to the State Engineer to appropriate water. (Tr. 1/7/2004 AM, at 3643:1-21.) Defendants proffer his testimony concerning the historical and current policies of the State Engineer as to the appropriation of groundwater from the Middle Rio Grande Basin:

> First, the State Engineer water right administration system and practices in the Middle Rio Grande Basin define and govern the permanent water supply, the amount of water available for appropriation, and the status of surface and groundwater rights in the basin.
>
> Second, within that administration or within those administrative practices, the State Engineer has long considered that the surface water of the Rio Grande and the groundwater within one mile of the Rio Grande, which covers or includes the area of the South Valley, . . . have long been fully appropriated. And thus, there is no groundwater available for appropriation, for new appropriation, in the South Valley, regardless of the contamination. . . .
>
> And third, the only water right holder in the South Valley area of water for drinking water purposes, the City of Albuquerque, have not lost their water rights. They have not lost their access to the supply for those water rights as a result of the contamination event. At most, the City has changed the point of diversion to continue to exercise that water right by withdrawing water from the same supply which is the aquifer in the Middle Rio Grande Basin.

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[74]B.S., 1970, electrical engineering, New Mexico State University, B.S., 1976, civil engineering, University of New Mexico; Mr. Cooper has 39 hours of graduate school study in civil engineering, hydrology, etc. at the University of New Mexico. He worked at the Office of the State Engineer from 1976 to 1984 as an engineer in the water rights division. (Transcript of Hearing, dated January 7, 2004 A.M. Session ("Tr. 1/7/2004 AM"), at 3641:8-20 (testimony of Mr. Cooper.)

(*Id.* at 3646:2-3647:4.) Ultimately, Mr. Cooper opined that "the State's interest in making water available for appropriation for drinking water purposes has not been harmed by the contamination event." (*Id.* at 3647:5-8.)

Mr. Cooper testified as to the importance of the Rio Grande Compact in the history of administration of water rights in the Middle Rio Grande Basin, explaining that within one mile of the river, the State Engineer had disallowed new appropriation of groundwater for some time, and had expanded that restriction beyond the one-mile range in issuing the administrative guidelines in 2000. (*Id.* at 3648:7-3652:15.) If the City of Albuquerque needs to extract additional groundwater, it would be required to do so at some distance away from the river—and away from South Valley—to prevent depletion of the stream flow in violation of the Rio Grande Compact. (*Id.* at 3653:19-3654:2.)

Mr. Cooper compared total water volumes produced by the city before and after the South Valley contamination was discovered, observing a steady increase after 1980 (89,000 acre-feet) up to a peak of approximately 129,000 acre-feet in 1989, followed by a gradual decline to 110,000 acre-feet in 2000, a trend that Cooper attributed to the city's "aggressive water conservation program." (*Id.* at 3655:13-3657:4.) He also described a gradual decline in production from wells near the river, including South Valley's San Jose well field, and an increase in production from "mesa wells" at some distance from the river. (*Id.* at 3656:10-3660:18.) Currently, approximately 83 percent of production comes from "mesa wells" and 17 percent comes from "river wells" such as the San Jose

field (approximately 2,500 acre-feet/year). (*Id.* at 3660:18-20.) According to Mr. Cooper, using this approach the city has been able "to increase their production of drinking water from their wells while maintaining the depletion on the river such that the river is kept whole." (*Id.* at 3660:25-3661:3.)[75]

3. Prof. Emlen Hall

Emlen Hall, Professor of Law at the University of New Mexico, testified as to the legal and administrative history of the Rio Grande River and the Middle Rio Grande Basin, particularly the effect of the Rio Grande Compact, and as to the absence of any impairment of the appropriation of Middle Rio Grande Basin groundwater as a consequence of contamination at South Valley. Professor Hall reached four central conclusions: (1) "as a matter of the history of the administration of the compact and of the surrounding . . . state administration, that no person had lost water rights as a result of the alleged contamination in the South Valley"; (2) that no water rights holder "in this area had lost his source of supply with respect to this area"; (3) that "the public had not lost the ability to allow the appropriation of . . . unappropriated water by virtue of the contamination"; and (4) that the foregoing conclusions are true "because of the history of the Rio Grande Compact and . . . the resulting history of the administration [of] water rights in New Mexico in response to that compact." (Tr. 12/11/2003 PM, at 3220:12-3221:11 (testimony of Prof. Hall).) He testified in detail concerning the Rio Grande

[75]Mr. Cooper testified that the City of Albuquerque may deplete the volume of the Rio Grande River by approximately 22,600 acre-feet per year. (*Id.* at 3660:1-11, 3661:8-9.)

Compact and the history of State administration of water rights in the Middle Rio Grande Basin, including the early recognition by the State Engineer of the interrelated nature of the river and aquifer and the resulting connection between surface and groundwater rights. (*Id.* at 3221:24-3244:20.)

Professor Hall's conclusions are framed in terms of the ultimate issue of injury to the State's interest in making groundwater available for appropriation. His substantive testimony, however, in large part proves to be descriptive of the historical materials and the relationships that exist.

Indeed, apart from Mr. Connor, the proffered testimony of the civil engineers likewise is largely descriptive—descriptive of history, descriptive of public documents, descriptive of the content of reports, documents and data available to all. In that respect, description proves more susceptible to testing and verification than the more uncertain processes of inference or prediction, and doubts about Rule 702 reliability of descriptive opinion testimony are more readily resolved than doubts about opinion testimony asserting the existence or non-existence of facts either unobserved or unobservable.

The court is satisfied that the proffered testimony by these witnesses meets the Rule 702 standards of reliability and may be of assistance to the trier of fact, at least as background or context for the determination of the pertinent factual issues. However, to the extent that these witnesses make a critique of Dr. Williams' modeling and estimates, Dr. Brookshire's valuations or the Stetson/Johnson analysis, the exclusion of these

analyses renders superfluous the corresponding criticism of their methodology proffered by Mr. Connor and others.

4. The Natural Resource Economists

Much the same is true of the proffered testimony by the Defendants' natural resource economists, Dr. Tomasi and DesVousges

a. Theodore Tomasi

Dr. Theodore Tomasi[76] was asked to "evaluate whether and how natural resources may have been damaged due to contamination in the South Valley," and "to evaluate the work done by plaintiff's economics experts to see if that was consistent with standard and reliable economic methods and techniques that resource economists use in this kind of work." (*Id.* at 3682:21-3683:2.)

At the outset, Dr. Tomasi outlined the conceptual approach he would use in valuing natural resources and evaluating an injury to natural resources, analyzing the problem in terms of the reduction or loss of resource services and the behavior of "economic agents." (*Id.* at 3683:3-3686:21.) According to Dr. Tomasi, "'It is imperative to distinguish between physical and economic effects. An environmental insult with immense results on natural scales might have a trivial economic consequence because there are close substitutes for the resource in question.'" (*Id.* at 3686: 4-9 (quoting

[76]B.A., 1978, environmental public policy, University of Colorado, M.A., 1979, economics, University of Colorado, Ph.D., 1984, natural resource economics, University of Michigan,. (Tr. 1/7/2004 AM, at 3679:5-10 (testimony of Dr. Tomasi).)

Gardner Brown, *Economics of Natural Resource Damage Assessment: A Critique*, in Kopp & Smith, eds., *Valuing Natural Assets* (Resources for the Future 1993)).)

Applying his approach to the facts of this case, Dr. Tomasi concluded that "the State of New Mexico has suffered no damages as a result of the contamination in the South Valley." (Tr. 1/7/2004 AM, at 3687:19-21; *see id.* at 3687:24-3689:4, 3689:18-3694:5.) Of relevance to the triable issues, Dr. Tomasi opined that as to *in situ* groundwater services as "drought reserve," no past need to tap a drought reserve appears in the materials he examined, and therefore, the State has suffered no past loss of that *in situ* service.[77]

As to future services as drought reserve,[78] Dr. Tomasi applied "the least cost principle," *viz.*, "What are the least cost possible responses in adjustments that individuals could make?" (*id.* at 3694:11-13), to arrive at three possible adjustments: "The first would be a restoration action, so you restore the services of pumping exactly from the San Jose well field in the SJ-6 location with . . . a wellhead treatment kind of approach . . . ."; "Another possible response in adjustment would be a replacement" by purchasing an agricultural water right and move it to municipal use, or third, to "not make a replacement or a restoration," requiring individual households to "mak[e] do with a little less water

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[77]Dr. Tomasi also found no loss of extractive services because even after the San Jose 6 Well was shut down, "there was ability to pump as much water as the City needed. And that continues into the future." (*Id.* 3696:2-10.)

[78]Dr. Tomasi acknowledged "that there is a potential loss" of *in situ* drought reserve services "because stock was contaminated," but this would be a loss to a water rights holder rather than the State. (*Id.* at 3696:11-3697:16.)

delivered to them," *i.e.*, a resource conservation adjustment. (*Id.* at 3694:15-3695:23.)[79]

As to damages, Dr. Tomasi offered a particularly cogent observation:

> "Under certain conditions, the cost of restoring a resource or replacing its lost services can be taken as a measure of economic damages. The first condition is that the restoration or replacement actually be undertaken. This provides assurances that people actually value the lost services at least as much as the cost of replacing or restoring them."

(*Id.* at 3712:8-15 (quoting Dr. A. Myrick Freeman, III, *Natural Resource Damage Assessment for the Charles George Landfill* (Industrial Economics 1990)).)

Dr. Tomasi also offered a critique of the valuation analyses of Dr. Brookshire and Mr. Johnson, concluding that neither of them were grounded in valid economic principles and methods. (Tr. 1/7/2004 AM, at 3697:17-3713:21.) Those analyses having been excluded for want of relevance, the court need not determine the Rule 702 reliability or helpfulness of Dr. Tomasi's critique. The remainder of his proffered testimony may "assist the trier of fact to understand evidence or to determine a fact in issue," at least as relevant background to the evaluation of damages, if any, to be determined at the first phase of trial.[80]

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[79]Dr. Tomasi suggests that the economic burden of a future loss of *in situ* groundwater drought reserve services would fall upon water rights holders—here, the City of Albuquerque—as an impairment of existing water rights; it is the city, not the State, that would be planning for and drawing upon the "drought reserve," at least up to the 132,000 acre-feet per year that the city is entitled to under its current permits. (*Id.* at 3697:5-16, 3718:3-3719:23.)

[80]Among the triable issues outlined by this court is: "4. What amount of damages will reasonably compensate the State of New Mexico for the injury to its interest in that volume of *in situ* groundwater, measured by the cost of restoration, response costs, etc.?" (Memorandum Opinion and Order, filed April 6, 2004 (dkt. no. 1067), at 140.)

b. Dr. William H. DesVousges

Dr. William H. DesVousges, another natural resource and environmental economist,[81] was retained to provide an analysis of the damages analyses propounded by Plaintiffs' experts—Dr. Brookshire and Mr. Johnson, among others. (Transcript of Hearing, dated January 8, 2004 A.M. Session ("Tr. 1/8/2004 AM"), at 3914:17-3920:17 (testimony of Dr. DesVousges).) Like Dr. Tomasi, Dr. DesVousges concluded that neither Dr. Brookshire nor Mr. Johnson used "the standard economic methodologies that are associated with trying to quantify potential reductions in natural resource services." (*Id.* at 3921:7-10.)

Dr. DesVousges presented a detailed exposition of the analytical process he would apply in quantifying a reduction in natural resource services, evaluating the economic impact of the service reduction, and making a reliable estimate of the resulting damages. (*Id.* at 3923:23-3931:2.) In the latter regard, he testified that "the economist evaluates the three alternative damage measures that are available within economics."

> The first of those is the diminution in value. Has the value of those services been reduced as a result of the injury? . . .
>
> The second part is the restoration cost. And for example, with groundwater, wellhead treatment would be a form of that. Replacement would be simply drilling a new well. So what an economist does then is to look at different alternative damage measures.

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[81] B.A., 1972, economics, Stetson University, M.S., 1974, economics, Florida State University, Ph.D., 1977, economics, Florida State University; President, Triangle Economic Research, Durham, North Carolina, 1994 to present.

> The next part, then, is to identify what's the appropriate valuation component, and then calculate that.
>
> And then finally, economics requires you to choose the lesser of those three different damage measures. If you follow all three of those components . . . then the result will be a reliable estimate of damages.

(*Id.* at 3931:3-23.)

Measuring the Brookshire and Johnson analyses against his economic framework, Dr. DesVousges opined that both had (1) failed to quantify service reductions properly; (2) improperly assessed water flow and "stock" quantities; (3) ignored the economic principle of substitution; and (4) failed to apply standard economic valuation principles in estimating damages. (*Id.* at 3921:3-3923:17.) Both had failed to evaluate the State's interest in the resource services, failed to consider the least costly feasible alternative to the service reduction, and both had relied on market price data, methodologies and assumptions that prove to be unreliable in predicting future costs. (*Id.* at 3931:24-3956:8, 3959:21-3976:3.)

Dr. DesVousges' economic critique of the valuation analyses of Dr. Brookshire and Mr. Johnson, like that of Dr. Tomasi, addresses opinions that have been excluded for want of relevance; and like that of Dr. Tomasi, the court need not decide the Rule 702 reliability or helpfulness of Dr. DesVousges' critique at this point. Likewise, the remainder of Dr. DesVousges' proffered testimony as to economic analysis of natural resource damages may "assist the trier of fact to understand evidence or to determine a fact in issue," at least as relevant background to the evaluation of damages, if any, to be

determined at the first phase of trial.

III. CONCLUSION

During the course of the Rule 702 evidentiary hearing, it became apparent that the qualifications of the proffered expert witnesses were not in genuine dispute, and that each appears to be qualified to offer opinion testimony within his field of expertise consistent with the requirements of Rule 702.

The Defendants have filed a series of motions to exclude the testimony of Dr. Williams, Dr. Brookshire, Dr. Myers and Mr. Johnson (including the opinions originally proffered by Thomas Stetson). (*See* Motion by the Federal Defendants to Exclude the Testimony of Dennis E. Williams and Memorandum in Support, filed July 10, 2002 (dkt. no. 589) (joined by Chevron/Texaco Defendants, *see* Joinder, filed September 19, 2002 (dkt. no. 802)); Federal Defendants' Motion in Limine to Exclude Testimony of Thomas M. Stetson and Incorporated Memorandum in Support Thereof (dkt. no. 590) (joined by General Electric, *see* Joinder, filed January 14, 2003 (dkt. no. 953)); Defendants' Motion to Exclude Testimony of Dennis E. Williams and Brief in Support of Motion, filed July 10, 2002 (dkt. no. 602); Defendants' Motion to Exclude the Testimony of David S. Brookshire, filed July 10, 2002 (dkt. no. 607); Defendant ACF Industries Inc.'s Motion in Limine to Exclude the Testimony of Thomas M. Stetson, filed July 10, 2002 (dkt. no. 609);[82] Defendants' *Daubert* Motion to Exclude Testimony of David S. Brookshire, filed

[82](*See also* Supplemental Brief by Defendant ACF Industries in Support of Motion in Limine to

(continued...)

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July 10, 2002 (dkt. no. 613);[83] General Electric Company's Motion to Exclude Testimony of Plaintiffs' Experts Teitelbaum, Williams, Brookshire, Ganderton, Unsworth, Najm, Mansuy and Matson, and Memorandum in Support Thereof, filed July 10, 2002 (dkt. no. 639); General Electric Company's Motion to Strike the Untimely Fourth and Fifth Expert Reports of Plaintiffs' Expert Dennis E. Williams, filed January 10, 2003 (dkt. no. 948); 24 Defendants Chevron's and Texaco's Motion to Exclude the November 2002 and December 2002 Reports of Plaintiffs' Expert Dennis E. Williams Ph.D. and Joinder of GE's Motion to Strike These Same Reports, filed January 14, 2003 (dkt. no. 955); 21 Motion by Defendants Chevron and Texaco to Exclude Opinions of Plaintiffs' Expert Thomas M. Stetson, filed January 15, 2003 (dkt. no. 959). 20

In each instance, those motions are now GRANTED to the extent and for the reasons explained above.

In addition, the court has made findings and admissibility rulings pursuant to Fed. R. Evid. 702 as well as Fed. R. Evid. 401-403. In each instance, the court finds that the proffered expert witness is qualified to testify in the designated area of expertise in which his testimony is being offered. At least to the extent that it remains relevant to the issues awaiting trial, the court has found that the proffered opinion testimony is reliable, that is,

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[82](...continued)
Exclude the Testimony of Thomas M. Stetson, filed January 13, 2003 (dkt. no. 952); Corrected Supplemental Brief by Defendant ACF Industries Supporting Motion to Exclude Testimony of David S. Brookshire, filed January 14, 2003 (dkt. no. 958).)

[83](*See also* Chevron's and Texaco's Supplemental Brief Supporting its Motion to Exclude the Testimony of Plaintiffs' Expert David S. Brookshire, filed January 14, 2003 (dkt. no. 956).)

"(1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case." Fed. R. Evid. 702.

As to the proffered opinions of Brookshire and Johnson on estimated natural resource damages, and of Dr. Williams as to contaminant plume volume, content and location, as well as "buffer zone" volume and "lost safe yield," the court has found a lack of "fit," *i.e.*, a lack of relevance to the triable issues remaining in this case, and has concluded under Rule 702 that these experts' testimony will not assist the trier of fact because the proffered opinions do not fit relevant issues in the case. *See In re Paoli Railroad Yard PCB Litigation*, 35 F.3d at 745 n.13 ("the standard for fit is higher than bare relevance").

Other motions based on timeliness issues are denied as moot. (*See* Defendants Chevron Pipeline, Inc., Texaco, Inc. and Texaco Refining and Marketing, Inc.'s Motion to Strike Plaintiffs' Late-Designated Expert [Dr. Donald E. Myers], filed April 25, 2002 (dkt. no. 518); Defendant ACF Industries, Inc.'s Motion to Strike Plaintiffs' Late-Filed Expert Reports and Late Designated Expert, & etc., filed May 3, 2002 (dkt. no. 528).) By now, all of the parties have had an adequate opportunity to conduct sufficient discovery to prepare a response to the expert witnesses' intended testimony.

Finally, having heard and considered Dr. Myers' proffered expert testimony at the Rule 702 evidentiary hearing, General Electric Company's Motion to Exclude Testimony

of Donald E. Myers and Memorandum in Support Thereof, filed August 23, 2002 (dkt. no. 704), is DENIED. 62

SO ORDERED.

DATED this 7th day of May, 2004.

BY THE COURT:

/s/ Bruce S. Jenkins
BRUCE S. JENKINS
United States Senior District Judge