Quinn, Laura

From: J Sevilla [qmakeda@chesapeake.net]
Sent: Friday, July 09, 2010 4:31 PM
To: CalvertCliffsCOLAEIS Resource; Quinn, Laura; woody.francis@USACE.ARMY.MIL; Steckel, James; Arora, Surinder
Cc: Peter Saar; Peter Vogt; Michael Mariotte; Allison Fisher; Paul Gunter; Bruce Gordon; Chris Bush; William Johnston; fabiada@yahoo.com; Timothy Flaherty
Subject: June Sevilla submission to DEIS (DRAFT NUREG 1936) and FSAR - #2 of 3 emails
Attachments: Sevilla Submission to CC3 DEIS-FSAR-Q&A - Dr S Kidwell-April 19-2010.pdf; Sevilla-Exhibit 7a-Gernant1970-CoverPage.pdf; Sevilla Exhibit 6-Kidwell 1997 JSR-Moran fig 2 vogt and fig 4.jpg; Sevilla Exhibit 3-Bio Kidwell_ Susan PhD- April2010.pdf; Sevilla Exhibit 9-PVogt CV and Recommendation for Moran Fault testing CC3.pdf; Sevilla-Exhibit 1- Google Earth-Moran to CCNPP SK 4-16.pdf; Sevilla-Exhibit 2- CC3 site map with markers relating to Google Earth image.jpg; Sevilla Exhibit 8-Powars 2010 GSA abstract.pdf

Importance: High

TO: NRC - NUREG 1936 DEIS Staff Reviewers
NRC - FSAR Staff
NRC- Geological and Geotechnical Staff
US Army Corps of Engineers - Woody Francis
Laura Quinn - NRC
James Steckel - NRC

From: June Sevilla in behalf of self and Southern Maryland CARES

This is the 2nd of 3 emails submitted for consideration and ACTION, both on the DEIS and FSAR components of CCNPP Unit 3's application with NRC and USACE. This attachment is the Q&A conducted between June Sevilla and Dr. Susan Kidwell at the PSC 9218 Evidentiary Hearing, April 19, 2010. Also attached are the Exhibits referred to in the Q&A. This Q&A should be used in conjunction with Dr. Susan Kidwell's scientific analysis of CCNPP Unit 3's FSAR Rev 6, in form of letter to me, June Sevilla, submitted in the 1st email.

Dr. Kidwell's scientific review and analysis of the geological conditions at CCNPP as reflected in this Q&A and in her analysis of CC3 FSAR Rev 6, impacts decisions made in the DEIS because the conclusions drawn by NRC Staff and the US Army Corps of Engineers were based on geologic and geotechnical information which have been misrepresented by the Applicant in their FSAR, which also contains errors and omissions that affect not only the FSAR, but the DEIS likewise.

Please forward this information to all other NRC staff and US gov't agencies reviewing the DEIS and FSAR.

Thank you,

June Sevilla
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P.O. Box 354
Solomons, MD 20688

4/19/10 - Dr. Susan Kidwell, Expert ORAL Testimony, PSC 9218 EVIDENTIARY HEARING

Questions were asked by June Sevilla of Dr. Susan Kidwell as expert witness. Note that this testimony is a condensed version and more focused on the Moran Landing Fault Line that is suspected to traverse CCNPP property on the south side starting at Moran Landing and heading west, towards Mears Cove, crossing Route 4 and aligning with Sollers Road.

The CC3 power block and USEPR reactor is within a mile of this suspected fault line. The CCNPP Unit 3 CWS Cooling Tower, a massive concrete structure, 177 ft tall and diameter of 528 ft, is to be located less than half a mile from the suspected Moran Landing Fault line. Three independent lines of scientific evidence point to the viability of the earthquake fault on CCNPP property, but were totally ignored by the CC3 FSAR. Based on Dr. Kidwell's review of the CC3 FSAR Rev 6, there are glaring errors and inconsistencies in the FSAR. It appears also that there is a cover-up of the scientific evidence in the FSAR, which has far reaching effects that would negatively affect conclusions made on the DEIS, on public safety, on public water supply, and on the reliability of CC3 as a source of electrical power to the grid.

Three separate scientific evidence specific to Calvert Cliffs and CCNPP property were ignored in the DEIS (Draft Nureg 1936) and in the FSAR Rev 6 for CC3:

1. Although Dr. Susan Kidwell's 1997 JSR paper on Calvert Cliffs was used as reference by the writers of the CC3 FSAR, her concerns on drainage patterns and the possibility of a fault, emphatically expressed by her personally to the CCNPP consultant during an hour-long interview on this same subject, was totally ignored in the FSAR Rev 6.
2. Corroborating evidence of the possible fault on Calvert Cliffs almost directly below the power plant (1970 Maryland Geological Survey, Robert Gernant's Report of Investigations No. 12) was totally omitted from consideration in the FSAR and DEIS.
3. Preferred orientation of straight stream segments (NOT dendritic) indicative of faults, a basic and obvious geological condition when viewed from topographical maps was totally ignored.

Questions were asked by June Sevilla of Dr. Susan Kidwell as expert witness:

Q. Please state your name and where you live.
A. Susan Kidwell, I live in Chicago, Illinois.

Q. Dr. Kidwell, are you familiar with PSC case 9218 as it relates to Air Quality?
A. Yes, I had a chance to look over the information on what supports the Prevention of Serious Deterioration of Air Quality for the proposed Calvert Cliffs Unit 3.

Q. Are you familiar with where UniStar has indicated the location of the Calvert Cliffs 3 CWS Cooling Tower as shown in this document? (**Exhibit 2-UniStar's Concept Site plan**)
A. YES. It is located in the southern part of the BGE Calvert Cliffs Nuclear Power Plant property, close to the BGE property line with the private land that was previously owned by Mrs. Margaret Moran. I used Google Earth to locate the points in **Exhibit 2** and relate them to the points in **Exhibit 1**. (**Exhibit 1-Google Earth CCNPP to Moran Landing, ca. 2010**) The blue arrows in Exhibit 2 correspond with the red arrows in Exhibit 1 to gain a topographical perspective of the cliffs and the plant when viewed from above. Topographically, the CWS cooling tower location is situated near a 3-pronged stream that drains to the Chesapeake Bay and it is also near the eastern end of Johns Creek, which drains in a fairly straight line westward to St. Leonard Creek.

(J Sevilla: Let the record show that Dr. Kidwell's description of the CWS tower location and streams are also reflected in PPRP's submission to this hearing, ERD Figure 2-1 on page 2-3)

Q. Dr Kidwell, why is the location of the CWS Cooling Tower significant? (referring to Exhibit 1 and Exhibit 2)
A. Based on my own work and discussions with other geologists, it is in an area where a series of unusual geological features occur. These features include surprising changes in the elevation of beds above sea level between the existing BGE plant and the Moran property, and a tendency for streams in the general region to have fairly straight paths.

(J Sevilla -Please note on the record that Dr Kidwell's reference to BGE is also reference to the Calvert Cliffs Nuclear Power Plant where Unit 3 is to be built.)

Q. With regards to the CWS Tower location in Exhibit 2 (CC3 Concept Site Map): Why is the directional line of St. John's Creek important? (*see red dotted line*, Exhibit 1-Google Earth image of CCNPP in 2010)
A. Straight streams are very unusual – streams usually show a random branching pattern on maps, with small streams branching off of larger streams like a series of branching roots. When you see a map pattern where a large number of streams have fairly long straight stretches, with turns at fairly sharp angles into other straight stretches, you begin to suspect that the drainage pattern is being controlled by some underlying pattern of weakness in the rocks. I have interpreted the Calvert County Topographical map and made markings to show stream segments to indicate this underlying pattern of weakness in the rocks.

Exhibit 4 and 4a:: *Topographical map of Calvert County used by Dr. Kidwell in her 1997 paper was overlaid by Dr. Kidwell with stream segment orientations. This stream-oriented map(Exhibit 4) and its accompanying explanation(Exhibit 4a) are enclosures in Dr. Kidwell's June 26, 2010 analysis of the CC3 FSAR Rev 6*)

Q. Dr. Kidwell, how do you know this underlying pattern of weakness in the rocks to be factual?
A. Stream patterns on maps are one of the standard methods used to evaluate a region for possible faults, joints – which are simple cracks in the earth -- or other structural deformation of underlying rocks. These features create lines or bands of weakness in the rock that are easier for water to erode, and that's why streams follow these lines. A consistent map pattern, with one, two or three preferred orientations of stream segments, indicate the kind and direction of tectonic stress that the region is under.

Q. Susan, is that a professional opinion?
A. YES, it's a basic method of field geology that students are taught.

Q. Susan, what is your profession?
A. I am a geologist specializing in the geology of layered sedimentary rocks, and the William Rainey Harper Professor in the Dept of Geophysical Sciences at the University of Chicago. I advise graduate students in our doctoral program in sedimentary geology and paleoecology, and also teach undergraduates in sedimentary geology and field methods.
(**Exhibit 3**- BIO of Dr. Kidwell)

Q. Dr. Kidwell How come you are familiar with this area?
A. My doctoral dissertation research was a detailed analysis of the anatomy and origin of the Miocene-age sedimentary record in Maryland and Virginia. The exposures of Miocene sediments in the Calvert Cliffs were a major focus of my work, and I continued working of the Cliffs post-doctorally. I am also familiar with the Cliffs and the Bay because my grandparents bought property in the area in the late 1920s and so, like my parents, I grew up visiting Calvert County.

Q. Dr. Kidwell, did you publish work in this area that is particular to the area covering Calvert Cliffs Nuclear Power Plant?

A. YES, here is a copy of my publication (**Exhibit 5: 1997 JSR** titled, "Anatomy of Extremely Thin Marine Sequences Landward of a Passive-Margin Hinge Zone"). As illustrated in **Exhibit 1** (Google earth image) and **Exhibit 2**, the Concept Site Plan for Calvert Cliffs Unit 3, I have labeled cliff locations that correspond to figures in my 1997 JSR paper.

Note 1- Dr. Kidwell's 1997 JSR paper (**Exhibit 5**) was one of four attachments already submitted by June Sevilla to NRC, c/o James Steckel, on April 7, 2010, ADAMS # ML 101140123.) This JSR paper, the orientation of stream segments and drainage patterns in the CCNPP area were discussed in detail between Dr. Kidwell and John Baldwin of Lettis and Associates, one of the contractors hired by CCNPP for the CC3 project. This paper was acknowledged and used selectively by the writers of the CC3 FSAR. Rev 6 of the CC3 FSAR was analyzed by Dr. Kidwell and her report was submitted in form of letter to June Sevilla dated June 26, 2010, submitted to NRC and USACE July 9, 20101, for inclusion and ACTION in the DEIS and the FSAR)

Q. What is a JSR and what does the title of you paper mean in layman terms?
A. JSR is shorthand for the Journal of Sedimentary Research, which is one of the leading peer-reviewed technical journals in the subject, published by the non-profit Society for Sedimentary Geology. The paper describes the thickness, grain size, fossil content, and tilt of beds within the Cliffs – that's the anatomy part, just as you would study the anatomy of the human body. The journal accepted the paper for publication because it considers the nature of extremely thin sedimentary records – most geologists focus on thick records of sedimentary accumulation, but all of these eventually thin to feather edges. The Miocene strata of southern Maryland are the extremely thin landward edge of deposits from the Miocene sea that used to cover this area. These deposits are only about one-tenth as thick as similar age beds found offshore under the Atlantic continental shelf..

Q. What was the purpose of your 1997 JSR paper?
A. I was investigating whether the very thin Miocene layers in the Cliffs were simply miniaturized versions of thick records found offshore, like an edition of a history book that retains all of the text but has been reprinted on extremely thin paper and with a paperback. Alternatively it was possible that it was thin because portions had been omitted (like missing chapters in a book) or because the last, youngest part had been truncated (like chopping off the last set of chapters from a book) or perhaps because it was condensed into a qualitatively different form (like an abridged, Readers Digest version of a history book). I was not looking for any structural complications in the sedimentary record, and so was surprised when my measurements of beds detected features just south of the BGE indicator in my JSR Figure 2 on page 324 and also illustrated much clearer in (**Exhibit 6**) that suggested a possible fault. The suspected fault would lie in the topographically low area between Rocky Point and the BGE plant, as indicated by the "white area" on Figure 2 of my JSR paper .

Q. Your 1997 JSR paper titled, "Anatomy of Extremely Thin Marine Sequences Landward of a Passive-Margin Hinge Zone" contains Figure illustrations, specifically Figure 2 on page 324 and Figure 4 on pages 330-331. Would you please explain what those illustrations are? (**Exhibit 6**)
A. They show various cross-sectional views of the Calvert Cliffs – that is, they are diagrams of what you would see if you were standing slightly offshore on the Bay and looking at the Cliff face. The illustration at the top half of the page is a colored version of the same Figure 2 on page 324 of my JSR paper, marked up by a respected colleague, Dr. Peter Vogt. Dr Vogt and I discussed the fault location personally and I concur that he has the trace of the possible fault located correctly, at Moran Landing, with the correct motion of blocks on either side, and has the CCNPP correctly positioned at my label BGE. Dr. Vogt has "darkened" in a bed at the base of the CT-1 sequence, which obscures the pattern denoting sedimentary type for that bed, but this "darkening" was to accentuate the features supporting the fault interpretation. Figure 4 is simply a more detailed view of bed relations north (part B) and south (part A) of Moran Landing.

Q. What about the beds here suggest a fault?
A. What's suspicious is that sedimentary layers measured in cliffs on the south side of this gap in the topography appear to be at a higher elevation in cliffs on the north point side of the low area. All of the beds seem to be offset upward, which suggests later structural modification, such as a fault where rocks on the southern side are "up-thrown" relative to those on the northern side.

Q. Are there other features in this area that make you suspicious of a fault?
A. Yes. **Exhibit 7**: 1970 Maryland Geological Survey, Report of Investigations No. 12, "Paleoecology of the Choptank Formation (Miocene) of Maryland and Virginia", by Robert E. Gernant. Gernant's Figure 4 on page 10 is a picture of Calvert Cliffs at Conoy Landing indicates that on the northern, BGE side of this gap a series of beds at the base of the cliffs are arched up. This kind of feature, which we call a fold, is very unusual in the coastal plain. It reflects some degree of bending of rocks and does not form without tectonic stress. Folds are commonly associated with faults in areas under compression, so this is consistent with rocks to the south being shifted upward relative to rocks to the north.

(**Exhibit 7 and 7a** I personally scanned this picture of the Calvert Cliffs from the 1970 Maryland Geological Survey Report of Investigation Number 12, which was written by Dr. Robert Gernant. This photograph of the stretch of cliffs just south of the existing BGE plant shows part of the fold structure in my diagram. You can see that layers in the lower part of the cliff are tilted in such a way that they have a higher elevation in the southern (left) end of the cliffs than they have at the northern (right) end of the Cliffs. Throughout the rest of the Calvert Cliffs, beds tilt only downward toward the south (left), never upward like those here. Dr Gernant was sufficiently struck by this that it became one of the few photographs included in his report and he described it as a structural fold. Back on my Figure 2, you see how I have diagramed this fold in these beds, which is very localized, and that these beds resume the usual regional southward tilt once you are on the south side of the suspected fault.

Note 2, Exhibit 7: - Gernant's picture of Calvert Cliffs on page 10 of the 1970 MGS report is an enclosure in Dr. Kidwell's analysis of CC3 FSAR Rev 6 and her report was submitted in form of letter to June Sevilla dated June 26, 2010, submitted to NRC and USACE July 9, 2010, for inclusion and ACTION in the DEIS and the FSAR) Exhibit 7a is the cover sheet of the 1970 MGS report authored by Robert Gernant

Q. Are there any other features that are suspicious?
A. Yes. The final set of suspicious features are the many straight segments of streams in this region, which Dr. Vogt and Dr. Curt Larson, a retired geologist from the US Geological Survey, have also noticed and concur with. In consultation with Dr Vogt, we have sketched in the patterns that we find striking, using the Maryland Geological Survey Topographic Map of Calvert County as the base map (Exhibit 4- topographical map with stream segment markings is an enclosure in Dr. Kidwell's FSAR Rev 6 analysis). There are three sets of preferred orientation of stream segments. One is an East-West directed set, shown in bold solid black lines. Johns Creek is an example. A second set trends South-Southeast, which is almost perpindicular to the first set, and is shown using the double-lines. St. Leonard Creek is an example. The third set are mostly smaller streams and have a distinct but intermediate orientation (fine solid lines). These fine lines probably coincide with simple joints in the underlying rock – that is cracks in the earth and thus zones of weakness that streams seek out – but not necessarily cracks along which blocks of rock have moved differentially.

Q. What is the heavy dashed black line across the map?
A. That marks a persistent band of high elevation that runs across Calvert County, from Mrs Moran's former property at the southern edge of the BGE property, southwestward toward the Patuxent River. Sollers Road is built along this high land, in part. Given the evidence for a possible fault along the Moran/BGE property line, the folding in the Conoy Cliffs, and the offset elevation across the gap in the

cliffs, Dr Vogt and I wonder if this band of high land provides evidence for how the edge of the up-thrown block extends back into the County. This is our testable hypothesis.

Q If this Moran Landing feature turned out to be a fault, would it be unique?
A No. Faulting is known in the Virginia and Maryland Coastal Plains and in fact this was the theme of a special symposium at the meeting of the Geological Society of America in Baltimore last month. Dr David Powars of the US Geological Survey gave one of the talks at the meeting last month specifically about faults in Virginia, along the Potomac River, and in the central Chesapeake Bay that have remained active up into very recent time **(Exhibit 8)**

Q. What is your recommendation to verify this plausible Moran Landing Fault Line?
A. To determine the direction and extent of the plausible fault line, I concur with Dr. Peter Vogt's recommendation as stated in **Exhibit 9**

Q. Dr. Kidwell, has anyone connected with Calvert Cliffs Nuclear Power Plant ever contacted you about your 1997 JSR paper?
A. YES, a few years back, a consultant, John Baldwin of William Lettis and Associates in California, contacted me specifically about my 1997 paper. Our approximately one-hour phone discussion was about the postulated fault at Moran Landing and possible structural control of drainage patterns in Southern Maryland.

Q. Did you ever get feedback from that phone interview? Any studies, or sampling or paper?
A. No.

Q. Dr Kidwell, based on your analysis, what can you say about the location of the CC3 CWS Cooling Tower?
A. The CC3 CWS Cooling Tower is located approximately less than half a mile from the postulated Moran Landing Fault.

MARYLAND GEOLOGICAL SURVEY

Kenneth N. Weaver, Director

REPORT OF INVESTIGATIONS NO. 12

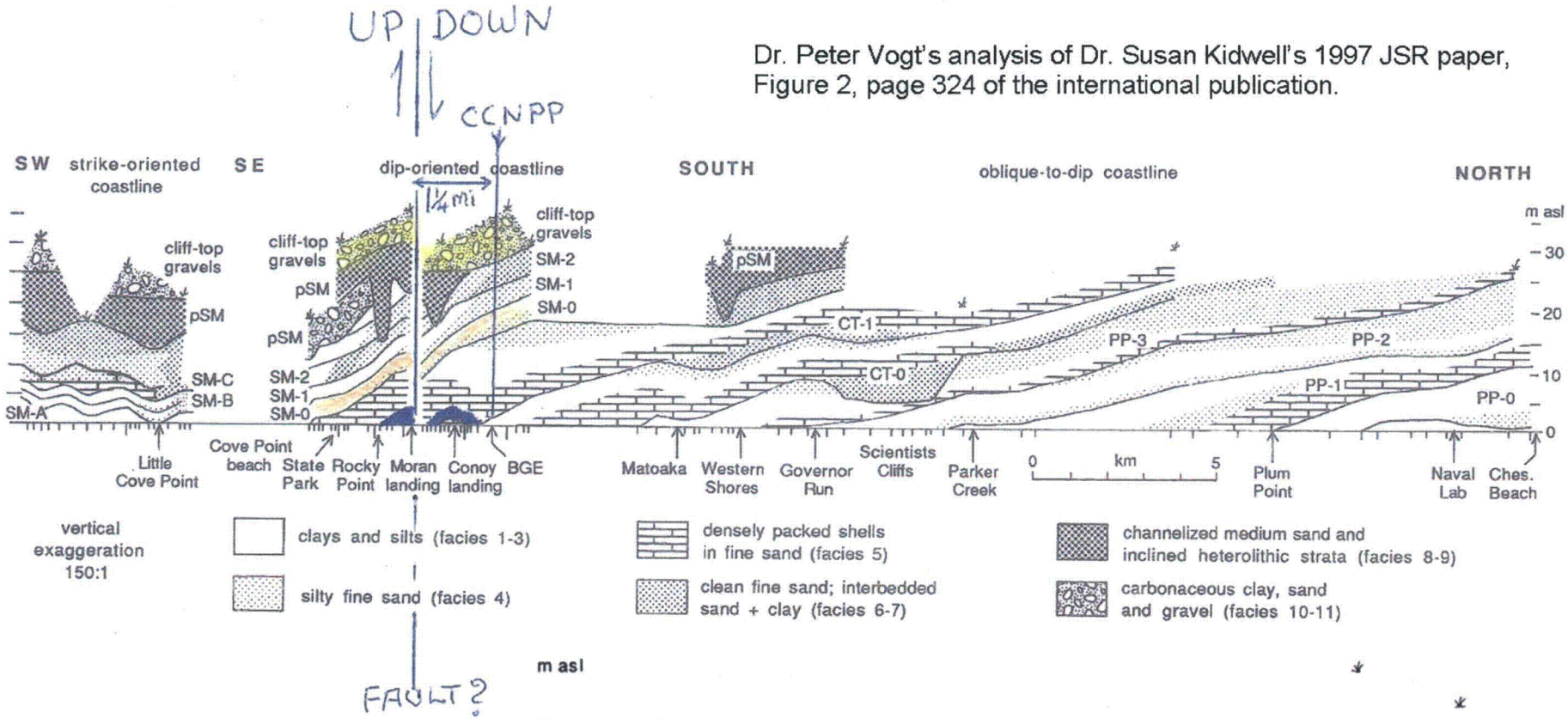
PALEOECOLOGY OF THE CHOPTANK FORMATION (MIOCENE) OF MARYLAND AND VIRGINIA

by

Robert E. Gernant

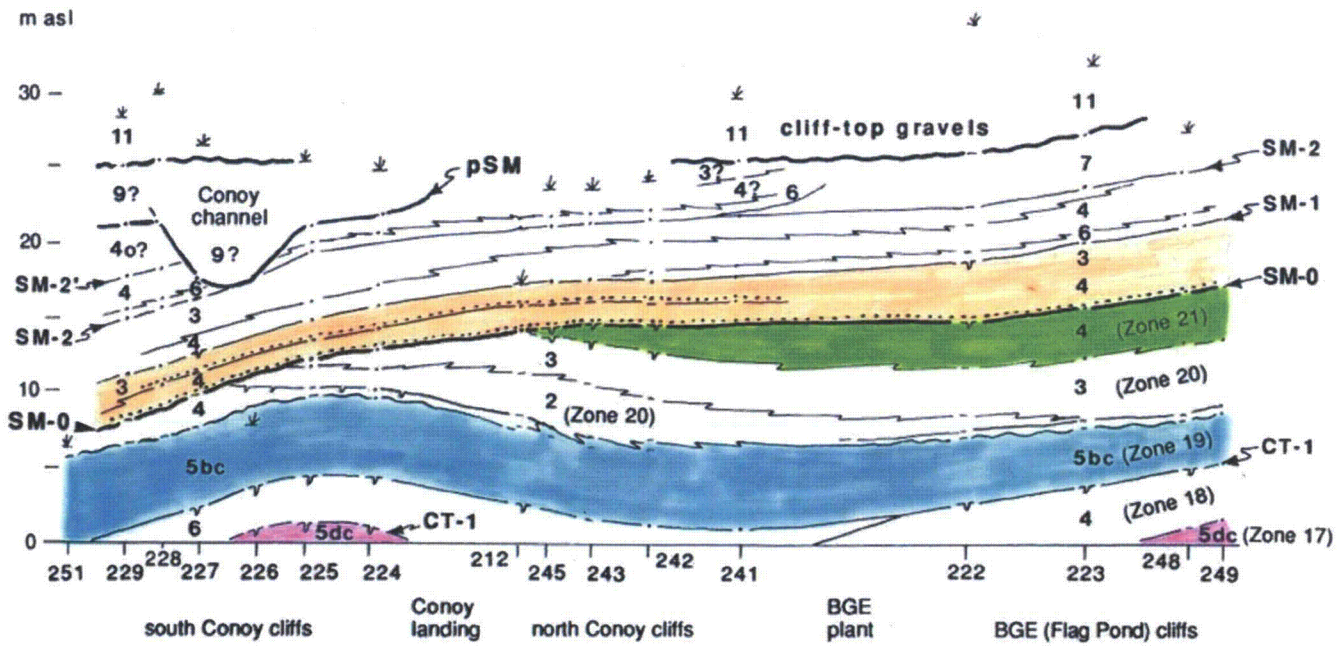
1970

Dr. Peter Vogt's analysis of Dr. Susan Kidwell's 1997 JSR paper, Figure 2, page 324 of the international publication.



Figures 2 and 4, from Dr. Susan Kidwell's 1997 JSR (Journal of Sedimentary Research) internationally published paper titled:

"Anatomy of Extremely Thin Marine Sequences Landward Of A Passive-Margin Hinge Zone: Neogene Calvert Cliffs Succession, Maryland, USA"



BIOGRAPHICAL SKETCH: SUSAN M. KIDWELL, PHD **APRIL 2010**

Degrees

College of William & Mary	Geology	B.S. 1976 Highest Honors
Yale University	Geology & Geophysics	M.S. 1978, Ph.D. 1982

Appointments

William Rainey Harper Professor (2003-present), Professor (1994), Associate Professor (with tenure; 1988), Assistant Professor (1985), Department of the Geophysical Sciences, Committee on Evolutionary Biology, and the College, University of Chicago

Assistant Professor (1981-1985), Adjunct Asst Prof (1985-87), Dept. Geosciences, University of Arizona

Distinctions

2004 Fellow Paleontological Society, 2003 appointed William Rainey Harper Professor (Univ Chicago), 2002 elected fellow American Academy of Arts & Sciences, 2000 Edward Allday Lectureship Univ Texas, 1999 Quantrell Prize for Excellence in Undergraduate Teaching, 1996 Schuchert Award of Paleontological Society, 1994-1996 Distinguished Speaker Paleontological Society, 1986-1991 NSF Presidential Young Investigator; Keynote lectures 1992 Geologische Verinigung "Sealevel Change" (Stuttgart), 2001 Internatl Conf Paleobiogeography & Paleoecology (Piacenza), 2001 International Assoc Sedimentologists (Davos), 2002 Internl Conference on Taphonomy (Valencia); 2001 *Discover Magazine* Science Story of the Year for Jackson et al. "Historical overfishing and the Recent collapse of coastal ecosystems"

Publications with geological details on Calvert Cliffs (of more than 70 total peer-reviewed pubs)

Kidwell, S.M., 1982. Stratigraphy, Invertebrate Taphonomy and Depositional History of the Miocene Calvert and Choptank Formations, Atlantic Coastal Plain, 514 p. PhD Dissertation, Yale University, Dept. Geology & Geophysics.

Kidwell, S.M., 1984. Outcrop features and origin of basin margin unconformities in the lower Chesapeake Group (Miocene), Atlantic Coastal Plain. In J.S. Schlee, ed., Interregional Unconformities and Hydrocarbon Accumulation. American Association of Petroleum Geologists Memoir 36:37-56.

Kidwell, S.M., J.A. Moore, and J.R. Moore, 1985. Inexpensive field technique for polyester resin peels of structures in unconsolidated sediments. Marine Geology 64: 351-359.

Kidwell, S.M. 1985. Palaeobiological and sedimentological implications of fossil concentrations. Nature 318: 487-460.

Kidwell, S.M., 1988. Taphonomic comparison of passive and active continental margins: Neogene shell beds of the Atlantic coastal plain and northern Gulf of California. Palaeogeography Palaeoclimatology Palaeoecology 63: 201-224.

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Kidwell, S.M., 1989. Stratigraphic condensation of marine transgressive records: origin of major shell deposits in the Miocene of Maryland. Journal of Geology. 97: 1-24.

Kidwell, S.M., and S.M. Holland, 1991. Field description of coarse bioclastic fabrics. Palaios 6: 426-434.

Kidwell, S.M., 1991. Condensed deposits in siliciclastic sequences: expected and observed features. In Cycles and Events in Stratigraphy (G. Einsele, W. Ricken, A. Seilacher, eds.), Berlin: Springer Verlag, p. 682-695.

Kidwell, S.M., 1991. The stratigraphy of shell concentrations. In Taphonomy, Releasing the Data Locked in the Fossil Record (P.A. Allison & D.E.G. Briggs, eds.). New York: Plenum Press, p. 211-290.

Kidwell, S.M., 1993. Influence of subsidence on the anatomy of marine siliciclastic sequences and on the distribution of shell and bone beds. Journal of the Geological Society of London 150: 165-167.

Kidwell, S.M., 1993. Taphonomic expressions of sedimentary hiatus: field observations on bioclastic concentrations and sequence anatomy in low, moderate and high subsidence settings. Geologische Rundschau 82: 189-202.

Kidwell, S.M., 1997. Anatomy of extremely thin marine sequences landward of a passive-margin hinge zone: Neogene Calvert Cliffs succession, Maryland. Journal of Sedimentary Research 67B: 322-340.

Other papers using data or insights from the Calvert Cliffs:

Kidwell, S.M., 1982. Time scales of fossil accumulation: Patterns from Miocene benthic assemblages. Proc. Third North Amer. Paleontol. Conv. 1: 295-300.

Kidwell, S.M., and D. Jablonski, 1983. Taphonomic feedback: Ecological consequences of shell accumulation. In M.J.S. Tevesz and P.L. McCall, eds., Biotic Interactions in Recent and Fossil Benthic Communities. New York: Plenum Press, 195-248.

Kidwell, S.M., and T. Aigner, 1985. Sedimentary dynamics of complex shell beds: Implications for ecologic and evolutionary patterns. In U. Bayer and A. Seilacher, eds., Sedimentary and Evolutionary Cycles. Berlin: Springer-Verlag, 382-395.

Kidwell, S.M., F.T. Furisch, and T. Aigner, 1986. Conceptual framework for the analysis and classification of fossil concentrations. Palaios 1: 228-238.

Kidwell, S.M., 1986. Taphonomic feedback in Miocene assemblages: Testing the role of dead hardparts in benthic communities. Palaios 1: 239-255.

Kidwell, S.M., 1991. Taphonomic feedback (live/dead interactions) in the genesis of bioclastic beds: keys to reconstructing sedimentary dynamics. In Cycles and Events in Stratigraphy (G. Einsele, W. Ricken, A. Seilacher, eds.), Berlin: Springer Verlag, p. 268-282.

Kidwell, S.M., 1993. Patterns of time-averaging in shallow marine fossil assemblages. In Taphonomic Approaches to Time Resolution in Fossil Assemblages (S.M. Kidwell and A.K. Behrensmeyer, eds.). Paleontological Society Shortcourse 6: 275-300.

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Kidwell, S.M., 1998. Time-averaging in the marine fossil record: overview of strategies and uncertainties. Géobios 30: 977-995.

Some Examples of other work

Kidwell, S.M., 2001. Preservation of species abundance in marine death assemblages. Science 294: 1091-1094.

Jackson, J.B.C., M.X. Kirby, & 16 alphabetic authors including S.M. Kidwell, 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293: 629-638.

Kidwell, S.M., 2002. Time-averaged molluscan death assemblages: palimpsests of richness, snapshots of abundance. Geology 30 (9): 803-806.

Kidwell, S.M. and S.M. Holland, 2002. Quality of the fossil record: implications for evolutionary biology. Annual Review of Ecology & Systematics 33: 561-588.

Kidwell, S.M., 2005. Shell composition has no net impact on large-scale evolutionary patterns in mollusks. Science 307: 914-917.

Kidwell, S.M., M.M.R. Best, and D. Kaufman, 2005. Taphonomic tradeoffs in tropical marine death assemblages: differential time-averaging, shell loss, and probable bias in siliciclastic versus carbonate facies. Geology 33: 729-732.

Lötze, H.K., H.S. Lenihan, B.J. Bourque, R. Bradbury, R.G. Cooke, M. Kay, S.M. Kidwell, M.X. Kirby, C.H. Peterson, J.B.C. Jackson, 2006. Depletion, degradation, and recovery potential of estuaries and coastal seas worldwide. Science 312: 1806-1809.

Kidwell, S.M., 2007. Discordance between living and death assemblages as evidence for anthropogenic ecological change. Proceedings of the National Academy of Science USA 104(45): 17701-17706. [Commentary by J.P. Smol, 2007. Marine sediments tell it like it was. PNAS USA104: 17563-64]

Kidwell, S.M., 2009. Evaluating human modifiation of shallow marine ecosystems: mismatch in composition of molluscan living and time-averaged death assemblages, p. 113-139. In G.P. Dietl and K.W. Flessa, eds., Conservation Paleobiology: Using the Past to Manage for the Future. Paleontological Society Papers Vol. 15.

Tomasovych, A. and S.M. Kidwell, 2010. The effects of temporal resolution on species turnover and on testing metacommunity models. American Naturalist 175: 587-606.

Excerpt from Vogt PSC 9127 Appeal draft 31 May 09
Recommendation by Dr. Vogt for verifying the postulated Moran Landing Fault
is concurred by Dr. Susan Kidwell

SUMMARY OF APPEAL: The appellant notes that PSC CCNPP report and all previous reports/studies, dealing with possible risks to CCNPP, especially the proposed third reactor, have failed to note the probable presence of a potentially active earthquake fault which intersects the Calvert Cliffs 1 ¼ mile south of CCNPP, and is likely to pass closer to CCNPP. This is the only such structure known along the entire Calvert Cliffs. Appellant strongly recommends delaying any permit until geological mapping by experts demonstrates said fault is real (not mapping errors), and if so demonstrated, that boreholes with sediment cores be taken on land, and seismic chirp profiling conducted offshore, to determine the strike (map trend) and dip (incline) of the fault, and its history of activity.

BACKGROUND FOR APPEAL: Among the risks that have to be evaluated at proposed and present sites of nuclear power plants are the risks from shaking from earthquakes. Most earthquakes are caused by failure (rupture) of the earth's crust or upper mantle along faults; occasionally they are associated with volcanic eruptions and very rarely, including the very greatest, by comet or asteroid impacts. Even though the reactor containment structure may be engineered to withstand a major earthquake, coolant pipes with small defects (e.g. bad welds) may break, or alarm systems triggered, and in areas such as Calvert Cliffs where earthquakes are rare, power plant employees fooled into an inappropriate response.

RECOMMENDATION: Given the possibility, or even probability, that a significant neotectonic structure ,"Moran's Landing Fault?"—a post-Miocene and potentially active earthquake-generating fault that offsets the strata exposed in the Calvert Cliffs such that the land on the south side has moved up relative to the north side- passes within 1 ¼ mile or less of the Calvert Cliffs Nuclear Power Plant, and that past CCNPP risk assessments—including the 2009 preliminary PSC report-- have failed to take this potentially seismically active (with high-frequency accelerations due to fault proximity) structure into account, this appeal recommends the following:

1) **No permit should be issued by PSC until detailed geological mapping, by experts, of the cliff exposures for at least several hundred meters on either side of the Moran's Landing area can discriminate with certainty between the "neotectonic fault" interpretation (considered more likely) and the "mapping errors" interpretation (considered less likely).** If (but only if) mapping errors are demonstrated, this appeal is groundless.

2) **In the event the Moran's Landing Fault (MLF?) is demonstrated to be real, no permit should be issued before a A) series of shallow (several hundred meters depth) boreholes have been placed, with core recovery and analysis, to determine the strike (trend) and dip (incline) of the fault, and of its offset history (when it was active, with an estimate of how often on average a fault offset occurred); and B) as a minimum a seismic 'chirp' profiler grid survey (similar to those conducted further north; see Vogt et al., 2000ab) be conducted in the Chesapeake Bay in the area where the putative MLF? would extend in the subbottom**. The chirp profiler could reveal evidence (or lack thereof) for offset of young sediment strata. The nearshore (with a mile or so of the cliffs) unconsolidated sediments range in age from a few thousand years (at most, a mile out) to zero (at the beach and in the shallow subbottom), so any offset of such strata along a fault would increase the odds of a new rupture in the future. It would also be helpful to **deploy a small array of seismometers for several months to detect any local, low-magnitude activity, below the threshold felt by humans or detected by regional networks**.

Excerpt from Vogt PSC 9127 Appeal draft 31 May 09
Recommendation by Dr. Vogt for verifying the postulated Moran Landing Fault
is concurred by Dr. Susan Kidwell

APPPENDIX : CREDENTIALS OF APPELLANT AND DISCLAIMERS, and GEOLOGICAL REFERENCES: The following is an abbreviated Curriculum Vitae, with selected publications. Disclaimer: The appellant is speaking as a geoscientist and long-time (40 year) Calvert County resident for himself only, and in no way on behalf of any institution or employer with whom he is or has been associated. While a geophysicist by profession, the appellant does not claim specialized expertise in the fields of earthquake seismology nor in engineering applications of such knowledge. While the appellant is familiar with the geology of the Calvert Cliffs, he defers to Prof. Susan Kidwell, University of Chicago, as the geologist most knowledgeable in this field, having herself mapped the geology exposed in the Calvert Cliffs. The primary basis for this appeal is the apparent break in continuity (suggesting an earthquake fault) mapped by Prof. Kidwell (Kidwell, 1997) at just one locality along the entire cliffs: the site she labels as Moran's Landing, about 1 ¼ miles south of the BG&E/Constellation CEG nuclear power plant and proposed site of third reactor. Publications cited in this appeal are prefaced by an asterisk (*).

1) Curriculum Vitae and selected publications by appellant

Home Address:
3555 Alder Rd.
Port Republic, MD 20676

Phone: 410-586-0067
EMAIL: ptr_vogt@yahoo.com

Education:

PhD (Oceanography) Univ. of Wisconsin, Madison	1968
MA (Oceanography) Univ. of Wisconsin, Madison	1965
BS (Science; Geophysics; "With Honor"), Caltech	1961

Von Karman Scholarship 1957-61
US Fulbright Scholarship, Univ. Innsbruck, Austria (Glaciology) 1962-63

Professional Positions:

Currently (2009): Research Associate, Smithsonian Institution; Adjunct Professor, Horn Point Environmental Laboratory ; Professional Researcher, Marine Science Inst., Univ. California at Santa Barbara

Marine Geophysicist, US Naval Oceanographic Office	- 1967-1975
Marine Geophysicist, Naval Research Laboratory	- 1976-2004
Sabbatical, Univ. Oslo, Norway	- 1978-1979

Professional Awards:
Within Navy:
Henry Kaminski Award, Research Society of America, 1971
(US Naval Oceanographic Office)
Alan Berman Research Publication Award, 1980, 1986, 1995
(Naval Research Laboratory)

Excerpt from Vogt PSC 9127 Appeal draft 31 May 09
Recommendation by Dr. Vogt for verifying the postulated Moran Landing Fault
is concurred by Dr. Susan Kidwell

Academia:
Fellow, Geological Society of America, 1973
Honorary Doctorate, Univ. Bergen, Norway, 2000
Foreign Member, Norwegian Academy of Science and Letters, 2000
Distinguished Alumni Award, Univ. of Wisconsin, 2003

Publications: over 150 authored or coauthored, and peer-reviewed professional publications, starting 1965. Those excerpted below demonstrate appellant's geoscience research publication history in the Chesapeake Bay, the western North Atlantic Ocean, global synthesis including seismicity, and geology of Calvert County, including the Calvert Cliffs.

Estuarine Processes & Gassy sediments: Chesapeake Bay

Hagen, R.A. and **Vogt, P.R.,** 1999, Seasonal variability of shallow biogenic gas in Chesapeake Bay, Mar. Geol., 158, 75-88.

***Vogt, P.R.**, Halka, J.P., Hagen, R.A. and Cronin, T., 2000, Geophysical environment in Chesapeake Bay: *Marion-Dufresne* Sites MD99-2205, 2206 and 2208, in Cronin, T., ed., Initial Report on IMAGES V Cruise of the *Marion-Dufresne* to the Chesapeake Bay June 20-22, 1999, USGS Open File Report 00-306, p.18-31.

***Vogt, P.R.,** Czarnecki, M. and Halka, J.P., 2000, *Marion-Dufresne* Coring in Chesapeake Bay: Geophysical Environments at Sites MD99-2204 and 2207, in: Cronin, T., ed., Initial Report on IMAGES V Cruise of the *Marion-Dufresne* to the Chesapeake Bay June 20-22, 1999, USGS Open File Report 00-306, p. 32-39.

Halka, J.P.,**Vogt, P.R.,** Colman, S.M. and Cronin, T.M., 2000, Geophysical Environment: Site MD99-2209, in: Cronin, T., ed., Initial Report on IMAGES V Cruise of the *Marion-Dufresne* to the Chesapeake Bay, June 20-22, 1999, USGS Open File Report 00-306, p. 40-48.

Colman, S.M., Baucom, P.C., Bratton, J.F., Cronin, T.M., McGeehin, J.P., Willard, D., Zimmerman, A.R. and **Vogt, P.R.,** 2002, Radiocarbon dating, chronologic framework, and changes in accumulation rates of Holocene estuarine sediments from Chesapeake Bay, Quat. Res., 57, 58-70.

Shah, A.J., Brozena, J., **Vogt, P.**, Daniels, D., and Plescia, J., 2005, New surveys of the Chesapeake Bay impact structure suggest melt pockets and target-structure effect, Geology, 33, 417-420, doi:10.1130/G21213.1

Cronin, T.M., **Vogt, P.R.**, Willard, D.A., Thunell, R., Halka, J., Berke, M., and Pohlman, J., 2007, Rapid sea level rise and ice sheet response to 8,200-year climate event, Geophys. Res. Lett., L20603, doi:10.1029/2007GL031318

Synthesis and Review

Vogt, P.R. and Tucholke, B.E., eds., 1986, The Western North Atlantic Region, v. M of The Geology of North America, Geol. Soc. Amer., Boulder.

Vogt, P.R. and Tucholke, B.E., 1989, North Atlantic Ocean Basin; Aspects of geologic structure and evolution: An overview, in Palmer, A. et al., eds., v. A. of The Geology of North America, p.53-80.

Excerpt from Vogt PSC 9127 Appeal draft 31 May 09
Recommendation by Dr. Vogt for verifying the postulated Moran Landing Fault
is concurred by Dr. Susan Kidwell

Regional and Global Charts:

Simkin, T., Unger, J.,Tilling, R.I., **Vogt, P.R.** and Spall, H., 1994, This Dynamic Planet—World map and interpretations of volcanoes, earthquakes, plate tectonics and bolide impact craters, Second Edition, US Geological Survey (Chart).

*Simkin, T., Tilling, R.I., **Vogt, P.R.,** Kirby, S., Kimberly, P. and Stewart, D., 2006, This Dynamic Planet, Third Edition (chart and website), US Geological Survey Geologic Investigations Series, Map I-2800

Local (Southern Maryland) geology:

***Vogt, P.R.** and Eshelman, R., 1987, Maryland's Cliffs of Calvert: A fossiliferous record of Mid-Miocene inner shelf and coastal environments, in: Roy, D.C., ed., Geological Society of America Centennial Field Guide-Northeastern Section, v.5, Geol. Soc. Amer., p.9-14.

***Vogt, P.R.,** 1991, Estuarine stream piracy: Calvert County, US Atlantic Coastal Plain, Geology, 19, 41-44.

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2) OTHER PUBLICATIONS RELATED TO THIS APPEAL:

*Kidwell, S.M., 1997, Anatomy of extremely thin marine sequences landward of a passive-margin hinge zone; Neogene Calvert Cliffs succession, Maryland, USA, Jour. Sedimentary Research, 67(2), 322-340.

*Zoback, M.L., Nishenko, S.P., Richardson, R.M., Hasegawa, H.S., and Zoback, M.D., 1986, Mid-plate stress, deformation, and seismicity, in **Vogt, P.R**. and Tucholke, B.E., The Western North Atlantic Region, v. M in The Geology of North America, Geol. Soc. Amer., Boulder, p.297-312.

Below is an abstract of a technical presentation at the symposium of the Geological Society of America, by professional geologists who have done work in the Mid Atlantic Coastal Plain.
The evidence of geological faults in the Potomac River Valley and Central Chesapeake Bay Region underscores that faults are known in the region and are under active investigation. This is a topic of ongoing research among professional geologists.

Recent published discussions of definite or probable faulting in the region:

Dedicated symposium at the March 2010 meeting of the Geological Society of America in Baltimore (published in Geological Society of America Abstracts with Programs, Vol. 42, No. 1):
T3. Tectonic Significance of Buried Terranes of the Atlantic and Gulf Coastal Plains

Talks included:
EVIDENCE FOR BASEMENT-ROOTED COASTAL PLAIN FAULTS IN THE POTOMAC RIVER VALLEY AND CENTRAL CHESAPEAKE BAY REGION

By POWARS, David S.1, HORTON, J. Wright Jr1, HARRISON, R.W.2, SCHINDLER, J. Stephen2, and NEWELL, Wayne L.3, (1) U.S. Geological Survey, MS926A National Center, Reston, VA 20192, dpowars@visuallink.com, (2) U.S. Geological Survey, MS926A National Center, Reston, VA 20192, (3) U. S. Geological Survey, MS926A National Center, Reston, VA 20192

Marine and land-based seismic, core, and borehole data along the Atlantic Coastal Plain of the Potomac River Valley and central Chesapeake Bay reveal numerous faults that vertically offset the top of crystalline basement by 6 to 80 m, and most of these faults offset the overlying coastal-plain sediments from ~1 to 30 m. Many Cretaceous and Cenozoic high-angle reverse faults, normal faults, and folds are rooted in early Mesozoic and Paleozoic NE-trending fault zones that underlie this part of the coastal plain and produce horst and graben structures that coincide with interpreted basement structures and terrane boundaries. Many faults dip NW, a few strike NW, and some dip SE. The Stafford fault system (SFS) is a series of en echelon, NW dipping, high-angle reverse faults having vertical offsets up to 61 m, a subsidiary dextral component, and right-oblique as well as down-dip striations. The western part of the SFS coincides with the Spotsylvania high-strain zone, that separates the Chopawamsic and Goochland terranes, and locally coincides with the Fall Zone. A map of top of the crystalline basement suggests a ~30 km northward extension of the Stafford fault system (SFS) into Washington, D.C. and similar maps of the Tertiary suggest several faults are between the SFS and the Brandywine fault zone (BFZ), a closely spaced series of NW and SE dipping, high-angle reverse and normal faults. The BFZ coincides with the western boundary fault of the Taylorsville Triassic basin and the eastern margin of the Goochland terrane. Marine seismic data along the Potomac River and across the Chesapeake Bay reveal faults with similar styles and displacements from the SFS eastward to mouth of the Potomac River. Beneath Chesapeake Bay, the faults appear to be less abundant and have smaller vertical displacements across a gravity low interpreted as a granite pluton. Another concentration of faults coincides with the Sussex terrane boundaries. Recurrent Cretaceous and Tertiary fault movements in the coastal plain are evident from upward-decreasing offsets (top of basement up to 80 m, top of Paleocene up to 30 m). The latest movements produced small offsets (1-7 m) of Pliocene and Pleistocene terrace deposits, affected the distribution and preservation of stratigraphic units, and have modern geomorphic surficial expression.

Note: Dr. Vogt attended this symposium and spoke with Dave Powers and suggested he be asked to be involved in evaluating the postulates Moran Landing Fault feature. Dave Powars sounded interested and ready to do so!

Google maps Address

To see all the details that are visible on the screen,use the "Print" link next to the map.

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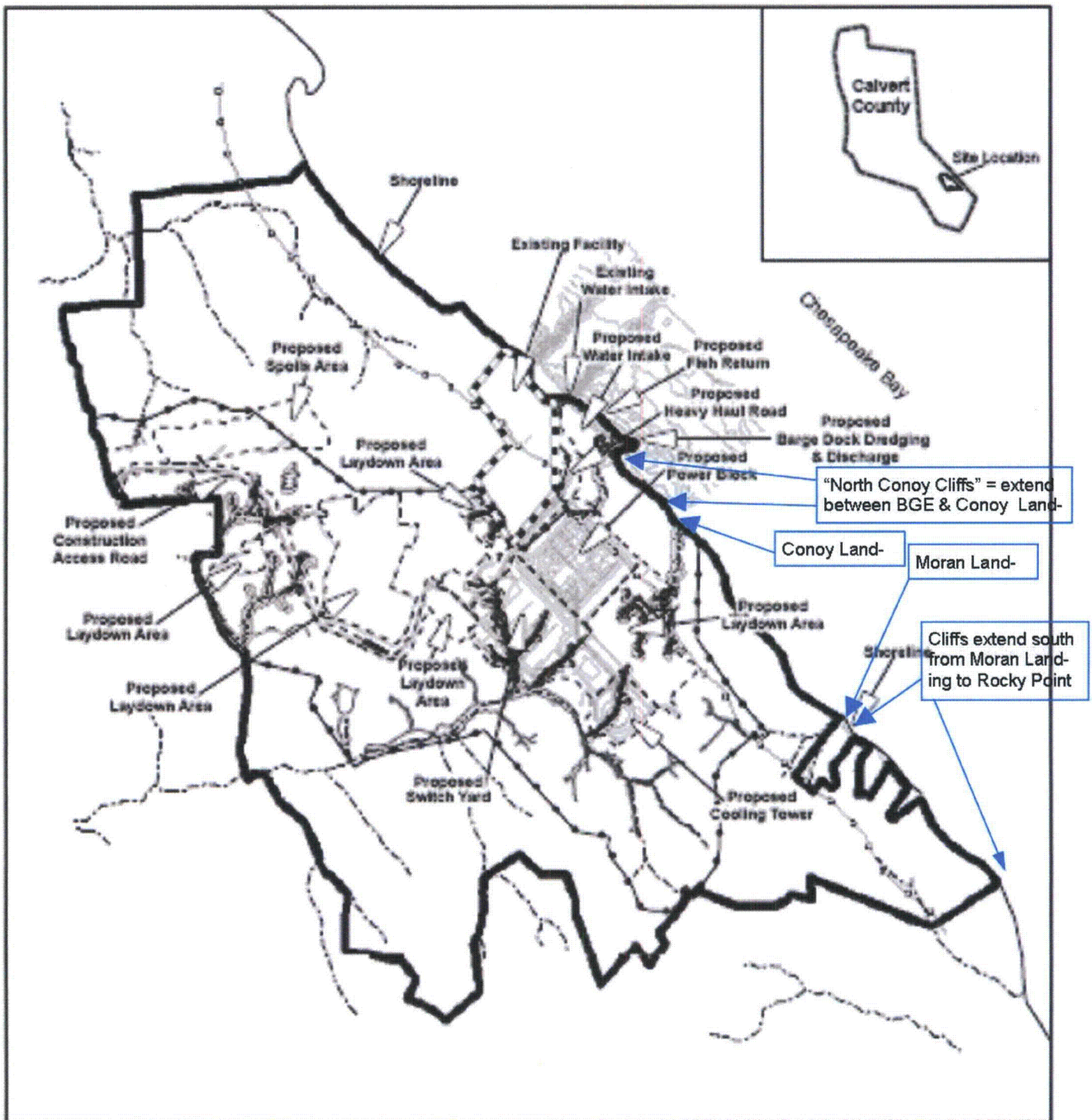

PURPOSE: PLANT EXPANSION

DATUM: (NGVD 29)

PROJECT LATITUDE/LONGITUDE:
38.424133
-76.441598

N

CONCEPT SITE PLAN

SCALE IN FEET

0 2,000 4,000 Feet

CALVERT CLIFFS NUCLEAR POWER PLANT

IN:
PATUXENT / WEST CHESAPEAKE BAY

COUNTY OF: CALVERT STATE: MD

APPLICATION BY:
CALVERT CLIFFS 3 NUCLEAR PROJECT, LLC
AND UNISTAR NUCLEAR OPERATING SERVICES LLC

DATE: 5/09/08 REV1 7/14/08