BEFORE THE ENVIRONMENTAL QUALITY COUNCIL

OF THE STATE OF WYOMING

DEPOSITION OF: RANAJIT SAHU, Ph.D., QEP, CEM
EXAMINATION DATE: August 15, 2008

IN THE MATTER OF:	)
	) Docket No. 07-2801
BASIN ELECTRIC POWER	) Presiding Officer,
COOPERATIVE, DRY FORK STATION,	) F. David Searle
AIR PERMIT CT-4631	)

PURSUANT TO NOTICE, the deposition of RANAJIT SAHU, Ph.D., QEP, CEM, was taken at 8:04 a.m., on August 15, 2008, at 555 Seventeenth Street, Suite 3200, Denver, Colorado 80202, before Patricia S. Newton, Registered Professional Reporter and Notary Public in and for the State of Colorado, said deposition being taken pursuant to the Wyoming Rules of Civil Procedure.

Patricia S. Newton
Registered Professional Reporter

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(Original exhibits are attached.)

PROCEEDINGS

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RANAJIT SAHU, Ph.D., QEP, CEM

The deponent herein, being first duly sworn to testify to the truth in the above cause, was examined and testified on his oath as follows:

MR. DAY: Robin, I've handed Dr. Sahu a copy of his expert report and his expert rebuttal report. I thought, unless you had an objection, that rather than make them deposition exhibits and require us all to pay for multiple more copies of these large documents, I wouldn't make them exhibits. But if you want them as exhibits, you can. But on the assumption you might not, I asked Dr. Sahu to confirm that I've given him two complete and accurate copies.

EXAMINATION

BY MR. DAY:

Q Can you do that, Dr. Sahu?

A Well, I have, in the last five minutes or so, just to be fair, glanced at it,

and I haven't done a page-by-page comparison.

It looks -- the expert report looks like it has all the citations. I just thought there were some Internet footnote citations that, you know, were provided that I didn't -- maybe I missed them. I didn't see them printed and copied. So as long as one can click on them and get to the Internet, I suppose they are complete.

Q Well, let's go ahead and make these two that I've marked formal deposition exhibits. That way, if there's ever a question about whether or not we haven't fully copied something, we'll be able to answer it.

A Yeah, I just -- again, based on a very quick look that you've given me.

Q Well, we won't take any chances.

Dr. Sahu, I'm going to hand you what we've marked as Deposition Exhibit 1. Can you identify it for us, please.

A It appears to be a copy of my rebuttal expert report in this case.

Q Okay. I want to ask you some questions first about your analysis on subcritical versus supercritical.

Can you tell me first, where did you

has to probably withstand higher pressures. There could be other reasons. I'm not sure of all the details of why a feed-pump design might change, but it's plausible it would have to because it simply would have to withstand higher pressures.

Q And you're going to have to make changes in the turbine, as well, aren't you?

A Well, the turbine -- portions of the turbine. The high-pressure section, for example, as we were discussing yesterday, would have to be different. Would have to be different.

Q Okay. And you'd probably also have to make some changes in the intermediate-pressure section of the turbine?

A Yeah. It depends on how many reheats you have and what -- you know, what reheat temperatures and pressures you're getting and where you introduce that into the turbine. That starts to get into the configuration of the turbine.

Q You're going to have to do a completely -- you're going to at least have to do an analysis of all the changes in the rotor

dynamics and a change in the turbine-lining size, as well, aren't you?

A Well, that's a turbine-design issue. I mean, a turbine manufacturer will balance the turbine and do the rotor design and make sure that the clearances are proper and -- under actual conditions and all the elongations are fine and the clearances are okay. I mean, that's part of -- when you go to a GE or somebody like that, they do that. Yes, that's part of the design.

Q Yeah. And that's why, when you go from subcritical to the supercritical, you've got to at least consider the design changes in the turbines, as well?

A Right. I mean, the high-pressure turbine portion certainly would have to be a different design.

Q Okay. And for a unit the size of Dry Fork, would you agree that the change is many millions of dollars to go from subcritical to supercritical?

A I would -- wouldn't doubt that. I think it would be a significant expense. And, therefore, the way I see it, that's why we're

-- that's what I meant by it's such an important decision, it should have been made right prior to incurring the many millions of dollars going down the wrong path.

Q Do you think Basin made the decision properly?

A Well, we just spent a long time on that. I think the decision as it was made, in my view, was not supported properly.

Q In your rebuttal report -- oh, no, I'm sorry, it's in your main report -- page 6 again, right where we were before --

A Okay. Sure.

Q -- right at the end of paragraph 12 -- it starts on the very end of page 5 and carries over to page 6 -- I want to refer you to where you start with, quote, Of course, in order to generate and accommodate these higher temperatures and pressures --

Do you see that --

A Yes, I do see that.

Q -- you say -- then I'm quoting from your report -- quote, boilers and turbines have to be designed with different materials and the like, period, closed quote.

Do you see that?

A I do.

Q Okay. Are all the changes that we've discussed what you meant by "and the like"?

A That's correct.

Q Are there others that you had in mind with this statement that we haven't covered?

A Well, I'm not -- sitting here right now, this was not meant to be an enumeration of all the changes; but this was to recognize the very fact that we were talking about: that boilers and turbines will be different between sub- and supercritical.

Q Your next sentence in your report says, "But to call this," quote, a fundamental redesign, period and closed quote, is flawed.

A Right.

Q Tell me what the basis for that opinion is.

A Well, I'm using this word "redesign" now as a term of art. When you say something is a redesign and therefore one cannot consider that within the context of a BACT or PSD analysis, it's a totally different technology, I believe that to be flawed.

I think subcritical and supercritical boilers, while they have differences -- and certainly subcritical and supercritical plants, while they have differences -- they're all part of -- they're all pulverized-coal combustion plants, they all make the end steam of a different quality that ultimately becomes electricity.

So I don't view supercritical and subcritical as so different fundamentally that they constitute a redesign. In fact, in support of that, I gave you that other statement, at least one other example fairly proximate in time, actually, with regards to another utility or another agency that felt like they were really the same system.

So in that sense, they're not redesign; they're doing the same thing. They're making the same product: They're making steam of a different quality, which is just becoming electricity starting from coal.

Q What does the product, when you use that term that you say "subcritical" and "supercritical," generate --

A Well, the --

Q -- make?

A -- plants make electricity; that's their purpose.

I understand Basin is going to generate electricity; it's not doing it for district heating or doing something else.

Q So you're saying the product produced by both supercritical and subcritical is electricity?

A Right.

Q Okay. Well, the product produced by a nuclear power plant is also electricity, is it not?

A Correct.

Q When you use the term "redesign," are you using that term within the context of BACT for purposes of determining whether or not this is redefining the source?

A Right, I was thinking of that.

Q Okay. I believe you're aware of the fact that EPA, at least, does not require a permit applicant to redesign the source as part of a BACT analysis, correct?

A I would -- I would -- I'm not trying to be facetious, but for me to sit here

and tell you what EPA thinks or doesn't think at any point in time would be far beyond my feeble powers.

I think EPA has not precluded the states from doing what they think they need to do to make decisions on this.

Q Okay, I understand that. But I read your testimony in the Sevier case, and you acknowledged in your sworn testimony in that case --

A Right.

Q -- that EPA's policy is not to require redefinition of the source.

A I think EPA has said that states do not have to consider redesigns, correct.

Q Okay. Some states do and some states do not, correct?

A Well, but EPA didn't define, again, in that statement what they meant by "redesign." That's part of the confusion, of course.

But what I'm saying here is, I don't think the difference between sub- and supercritical is a redesign issue from that context.

Q Okay. And what I want to make sure I understand now is the source of your opinion in that regard. When you say you don't consider supercritical to be a redesign of the source from subcritical, upon what basis are you making that judgment?

A I'll give you an example. There are other people who are similar, they make the same product, they start from the same raw material: coal.

You brought up electricity from nuclear, and I'm saying, well, we don't have to go quite that far. This is pulverized coal, as I think Mr. Snell indicated correctly, I believe. That entire coal-handling, coal-delivery system, all of that stays the same and all the back end stays the same.

Yes, the boiler has to be designed to different suitable metallurgy to take into account the steam characteristics. Yes, that is defined -- that is mechanical-design differences, but that doesn't make the supercritical technology a redesign from the BACT context.

Q Okay. And I understand that's your opinion, sir, and I don't -- I'm not trying

to be different: the metallurgy is different, temperature and pressures are different, but they're not a fundamental redesign; they're equivalent. I think they use the word "equivalent."

Q But you're understanding that to be in the context of whether or not they're fundamentally equivalent for purposes of whether or not they're the same technology for BACT purposes?

A Right. And just let me -- to be very clear, this is an example: I think the CH2M Hill report in the Dry Fork case is pretty persuasive on that issue, frankly.

Q Now, it's true, isn't it, that this letter and exchange of letters in Utah demonstrates that switching from supercritical to subcritical does not necessarily change any of the permitted emission rates?

A That probably was the context. I think at some point they made a technology decision that was a switch, and they didn't want to go through the permitted emission rates -- I mean, they didn't want to go through the repermitting, I believe.

Q Right. But I just want to make sure that you -- that I understand what you -- what your opinions would be with respect to emission rates. I mean, if we -- for example, at Dry Fork, if we were to switch from subcritical to supercritical, it wouldn't necessarily change any of the permitted emission rates for the controlled pollutants, correct?

A Well, it could, depending on the form of the emission rates. If you express them as pounds per megawatt hour --

Q But --

A -- it could, yes.

Q Okay. But generally speaking, you'd be looking at substantially the same control technologies, wouldn't you?

A You'd be looking at the same control technologies. Actually, the same control technologies.

Q And so for purposes of emissions issues, the benefits of subcritical are ultimately that you just burn less coal?

A Yes, you burn less coal; you therefore have fewer mass emissions for the same output of electricity.

Q Fewer mass emissions but not necessarily a difference in rates; would that be fair?

A Well, that's where we get into how the rate's expressed. If you want to capture that efficiency factor, you'd express the rates as per megawatt hour, and you would get lower rates expressed on a per-output, per-megawatt-hour basis.

Q Okay. Would you agree with the general proposition that for air-quality purposes, supercritical doesn't get you anything unless it does in fact achieve an improved efficiency?

A Well, that's a -- I believe that it will achieve an improved efficiency and, therefore, you will get an air-quality benefit.

Q I understand that you believe supercritical will generate more efficiency, but I'm trying to make sure I understand a separate point, which is that unless that in fact turns out to be the case, there's no air-quality benefit to going supercritical, agreed?

A Right. You need an efficiency improvement for the air-quality benefit.

MR. DAY: Okay. Why don't we go ahead and take a break.

THE DEPONENT: Sure.

(Recess from 9:29 to 9:48 a.m.)

Q (BY MR. DAY) All right. Dr. Sahu, I had just a handful of questions on redesign, then we can move on to a different subject.

In the process that you employed to determine whether or not something is a fundamental redesign or not, how do you answer that question with respect to IGCC technology? Is that a fundamental redesign, in your opinion?

A I think it falls more, in my mind, on -- it's definitely not pulverized-coal combustion, but I think if you look at a gasifier, there's certainly combustion going on in there to a certain degree. It's hard to avoid combustion at high temperatures when you have any oxygen.

I would think of it as falling -- as a production process that still uses coal to produce electricity, and maybe innovative, if you want to go that far, but I look at it on that basis as being another production process -- a

similar production process, if you will, when you look at the broad definition of: Are you starting with coal and ending up with electricity?

Q So, yes, you consider -- you do not believe that IGCC would be a fundamental redesign of the source?

A Yeah, but I have, to tell you the truth, not spent as much time looking at all the details and forming an opinion on that particular question. I'll be fair with you and say that I have certainly not recently looked at it and will try to answer that question for myself.

Q Okay. Well, I just want the record to be clear on your official position.

Is it your official, for purposes of where we are today, that you are expressing no opinion on whether or not IGCC is a redesign -- a fundamental redesign of the source?

A Right. Sitting here as I do right now, I haven't talked through that. I'm not expressing an opinion.

Q Okay. Do you have an opinion one way or another on whether or not circulized -- CFB -- I'll just do it that way -- would be a

redesign of the source: circulized fluid bed?

A Circulating fluidized bed: CFB?

Q Yes.

A It uses a different type of combustion, but to me, it's a lot closer to, you know, not being a fundamental redesign, because it's burning coal, combusting coal; it's doing it in a different manner within the boiler -- the CFB boiler as opposed to a straight PC boiler.

Q So that would not be a redefinition of the source?

A Yeah, I wouldn't think of that as being a redefinition of the source.

Q Okay. What about a stoker boiler?

A Let me ask a clarifying question here.

Q Yes.

A Are you starting -- when it comes to a comparison when you're doing redesigning, redesigning compared to what? Are you comparing it to a pulverized coal?

Q To Dry Fork.

A To Dry Fork. I don't think -- Again, I have not formed an opinion on

this, because there are so few stoker boilers, I don't normally think of stoker boilers, certainly in this day and age.

But I don't -- I haven't thought through that completely.

Q No opinion, then --

A No.

Q -- one way or the other?

A No opinion, sitting here right now.

Q In order to form an opinion on something like IGCC, you would have to just sit down and make your own personal assessment of the specific technologies and then do sort of a line-item comparison between them and Dry Fork to make a final evaluation of this question?

A Much the same type of process that I tried to answer. I mean, sort of look at the facts, look at the similarities, look at the dissimilarities -- there will always similarities and dissimilarities -- and then to see where I can personally support drawing the lines so at least I have a logical construct. That's how I perceive it.

Q Okay. Tell me about your

background and training in BACT analysis.

A Well, the background is -- I've been an air-pollution consultant now for roughly 18 years; and through that time, I think I've done my share of doing some BACT analysis, doing some LAER analysis, which is kind of related, doing a lot of reviews of BACT analysis, becoming familiar with the regulations that pertain to BACT analysis at EPA, various states that I happen to have worked in on projects, guidance documents.

And putting that all together, I'm more recently doing some expert work in that area, as well, probably in the last five to eight years. That's sort of an overall sense of my work in the BACT area.

Q Let's start with just the piece related to your expert work in this area: in the last five to eight years, I think you said.

A Yes, roughly since 2000.

Q What has that work been?

A That work has been looking at BACT analyses and permits, BACT assessments for sources that may or may not have triggered PSD, working for several cases laid out in my resume.