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1 portraying erosion corrosion to be a combined term
2 between the corrosion that we are now reserving to
3 mean flow-accelerated corrosion from that which is
4 caused mechanically as I interpolate him saying of an
5 erosion type of aspect. So what's your definition of
6 erosion under those assumptions that we're going to
7 reserve the word corrosion to be a shortened version
8 of FAC, flow-accelerated corrosion.

9 MR. HOPENFELD: Erosion, actually, I don't
10 even know -- it's completely separate from erosion
11 corrosion. I'll have to explain that. But strictly
12 speaking of erosion, my understanding would be you
13 have particles in steam, droplets in steam impinging
14 --

15 JUDGE WARDWELL: Is that steam droplet
16 impingement?

17 MR. HOPENFELD: Yes, that would be.

18 JUDGE WARDWELL: We separated that out.

19 MR. HOPENFELD: It could be called --

20 JUDGE WARDWELL: That's droplet
21 impingement, so back to the corrosion. If they
22 removed droplet impingement, do you agree with his
23 definition of erosion as a mechanical process --

24 MR. HOPENFELD: Not necessarily in the
25 context of corrosion and erosion, I can't separate it.

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1 I can explain to you why. You can't separate the two.
2 There is no acceptable theory as exactly what happens
3 during the erosion corrosion process. It is
4 acceptable for the last 30 or 40 years, but you don't
5 have enough shear stress, calculated shear forces
6 during normal flow. There is not enough shear there
7 to abrade or wash off, as NRC defines it, to wash off
8 that layer. There's been acceptance in the paper that
9 was written in '76 on that subject.

10 JUDGE WARDWELL: Let me stop you right
11 there.

12 It's my impression that flow-accelerated
13 corrosion isn't a physical washing off of the oxide,
14 but more of a chemical melting of it, my simplistic
15 mind, and I thought I heard Dr. Horowitz-- again, at
16 the next hearing I'm on, I'm going to limit how many
17 Hs are present for witnesses.

18 Dr. Horowitz seemed to agree to that.

19 MR. HOPENFELD: I took the next step.

20 JUDGE WARDWELL: There's no argument, no
21 one says there's enough shear forces to physically
22 remove it, but there's enough chemical action to melt
23 it, isn't there?

24 MR. HOPENFELD: No, no, no. NRC says it's
25 a washing away of the oxide.

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1 JUDGE WARDWELL: I'll get to the NRC.

2 MR. HOPENFELD: But back to what I was
3 coming to, there's no acceptable theory. There are
4 concepts. One concept I'm familiar with that has to
5 do -- that you can have very, very -- some velocity.
6 You may have sufficient, sufficient shear force. It
7 doesn't take much to affect the cohesion, to affect
8 the oxide layer. And I am not an expert on oxide
9 layer characteristics and all the details of that.
10 That's one theory. There are other theories that Dr.
11 Hausler has proposed, the creation of local extremely
12 high pressure. I'd rather he talk about that.

13 Their definition doesn't cover those acts,
14 those two acts as I just said.

15 JUDGE WARDWELL: Dr. Hausler, would you
16 like to expound on that in regards to the definition?

17 DR. HAUSLER: Yes, sir. Your Honor,
18 actually, I would. With your permission I would like
19 to cut through this fog of definition fairly quickly.

20 What this demonstrates that in fact over
21 the years the corrosion engineers have made confusion
22 in their semantics. And the chronology has developed
23 over the years. I mean perhaps to be more specific as
24 to what it is that I want to say.

25 Originally, erosion has been used for

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1 corrosion phenomena were the two extremes, were, in
2 fact, mixing with the salts, salts mixed into the
3 fluid streams. We did, in fact, then have abrasion,
4 mechanical removal of the surface layers. Now this is
5 not what we're looking at.

6 JUDGE WARDWELL: So are you saying we
7 don't have to worry about the erosion part of erosion
8 corrosion?

9 DR. HAUSLER: I think that the corrosion
10 engineers have, in fact, used erosion just like Dr.
11 Horowitz and as Mr. Fitzpatrick indicated in areas of
12 high turbulence where you have high turbulence and you
13 get somewhat localized corrosion, but without the
14 definition of what localized really means. And that
15 the corrosion engineers have identified that as
16 erosion.

17 To approach the problem, I think we would
18 be a lot better off to look maybe at the mechanism of
19 that fundamental. And here is what I would say is
20 that both are corrupt as well as what we might call
21 erosion corrosion due to high turbulence in a specific
22 location are, in fact, due to a dissolution mechanism
23 of the oxide layer on the surface. And the reason for
24 that is that very recently in Germany calculations
25 have been made with respect to the compressive

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