# APPENDIX I:

# CONVERSATIONS WITH AND LETTERS TO DR. ALFRED BEDARD, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

## APPENDIX I: CONVERSATIONS WITH AND LETTERS TO DR. ALFRED BEDARD, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

### Transcript of First Conversation

Tape of NOAA conversation, J. Weber (**JW**) (*RAC*), R. Meyer (**B**) (*RAC*), A. J. Bedard (**N**) (NOAA meteorologist). 4/16/98 at NOAA lab in downtown Boulder. 10 - 11 AM. Tape held by R. Meyer.
Transcribed 5/20&21/98 - HRM.

(Tape starts in mid-sentence):
…and I presume some version of that. started to the left with north, so what do you end up with?
**JW:** that was..
**N:** that was north, east, south, west, north.
**JW:** we're at 3 AM GMT, so that would be minus 7, right? So, it's sometime in the middle of the night here.
**N:** the thing that concerns me a little bit here is that that would say that the wind from this event would be from the NE, which doesn't make sense. So that's how mine was.
**JW:** and this would be the interpretation if it was, if you just went through one cycle of 360 degrees.
**N:** this paper may be helpful. We could probably go up and get the journal, because they're talking about the '72 event, my memory is that they had the wind records in this paper, and that would give you a reference closer to your time. You could almost, I would tend to presume that this was either from the west or maybe you could expect.
**JW:** and if you hold this one up to it, like if you think about this then we're starting from the south and its progressing to the westerly winds.
**N:** so if this is 45, one, two, three, four, five divisions.
**JW:** that's what I'm having the trouble with.
**N:** that would be 75 degrees per division, that doesn't make sense. One through ten would make it 36 degrees per division, so if this is zero, 36, 72.
**B:** that would be 144.
**N:** so we have one through five.
**JW:** still not quite right is it?
**N:** you would be expecting this to be the center of, here. Let me take a run up, I think it would be worth it to get this straight. There are other references here, but I think that this particular one.
**JW:** OK
**N:** maybe rather than the fact that it's going across here, and then flipped over right from the side. They probably got the scale so they wouldn't have a problem going from 360 to ...
**B:** When we saw those, we were interpreting those as flipovers from the chart, and I'm also.
**N:** but I don't see any evidence that this has really gone the full extent over here and then flipped it over. What we've found is that the tremendous variability in the windscale is huge, and...I'll give you this paper. This is '82 there was a bad windstorm and it showed tremendous variation in speed and direction at that particular site. That site is really susceptible to that. Now this one looks suspicious, as if something is flipping over. So.
**JW:** that's a pretty low wind speed.
**B:**: before the final.

**JW:** as we looked at these, what we felt like we were noticing at least is that when the wind was higher, it looks like it settles into a wind direction, and as it decreases... is that true, do you see that.
**N:** frankly I haven't really notice that a lot. What I have noticed, and we have this published, is that you look at this particular, we had an array of sensors throughout the Boulder valley, but roughly there were a line of about 10 km. This is the site that you're talking about, NCAR, and then there's a couple of them in Table Mesa, that's about middle of the valley, sloped from the mesa there, this is south Boulder Road(?), and as you look at the wind direction, say you had a histogram hour of wind direction every 30 seconds and it might show something like this. Now this is zero to 360 degrees, maybe west, and if you look at this histogram for this site, and it would be something like this. This one is probably similar, and then you go to here, and the histograms get a lot wider, and this one is very very wide, there's almost a 180 degree variance in terms of wind speed.
**B:** where are the foothills?
**N:** think of this, maybe the foothills start with NCAR.
**JW:** so what's happening at Rocky Flats may not be well represented....
**N:** I don't think so, in terms of variability, variability showed an east/west, a tremendous east/west

**JW:** east/west differences, not centered on the same...
**N:** right, centered on the same direction of, pretty close, with same site location, we had north south things as well. We had 30 sites in the Boulder valley for that experiment that we ran. But both windspeed variability and wind direction variability was very high as you got closer and closer to the foothills. and I interpret that as more and more vorticity and lots of turbulence and fine structure.
**B:** what would be the best of the stations that we had available here, Kent and so on, Rocky Flats, speed/direction, would you say?
**N:** my memory is that the Kent one would probably be closer to the NCAR bases. But you don't have a continuous data set for that, I guess.
**JW:** yeah, Kent is here, Rocky Flats is here, so Kent would be like one of these, maybe.
**N:** I would guess so, and I would imagine Rocky Flats, if you're thinking not of the gate, but inside the plant itself, would be more like this. We had a site at Davidson Mesa (basin?), see if there's a paper in here..., this thesis would be very helpful to you I would think.
**JW:** but we have read that, that Brinkmann thesis.
**B:** yes
**JW:** we at least have her interpretation of the data.
**N:** but she may have published some of the time traces. Either in her paper or in the thesis.
**B:** that's a nice piece of work
**N:** That's right.
**JW:** what about, so if we don't, OK, we have Kent data for the 30th, we have it for the March, we're really concerned about the five events that are sort of the big ones we've seen high wind speeds at these, extremely high concentrations of Pu in the environment, and so we're trying to use the wind speeds to predict resuspension from areas in Rocky Flats. We have Kent for Jan 30, March 19, April 7, are three of the big ones. We don't have Kent for this Jan. 7 event, we only have Table Mesa. And then Dec. 5 of '68 was also a big one. Would we be well served to use

Kent since we have it.
**N:** well, it's certainly more representative of... this is a Chinook type event, you think of the interaction of the lee wind speed fairly in a north south direction fairly uniform in terms of distance interaction zone relative to the mountains, so you'd expect that to extend some decent distance anyway.
**B:** what effect would the Rocky Flats mesa itself have on the difference between the two sets of data?
**N:** mesa has the effect of raising the .... the base is the south end of the Boulder valley, seems to show a higher contour of winds, so this is during a Chinook event in... it's comparable to these kinds of things. Did a lot of damage. And what we found, we have contours that we drew follow the top of Davidson mesa, which doesn't go off that far. I mean, this is higher than Rocky Flats is, by a fair amount, so you might take, I don't know what the relative height is of this part of the Boulder valley relative to the center of the Flats, but you might imagine that this anomaly is caused by the high ground of the mesa south of Boulder, and then it would drop down again in a similar manner on either side of that... What people in JeffCo, the city based on microzonation on this plot, and the people of Jefferson County extended the edges of this plot just out, and that's how they made up their zoning, I would have felt like they should have gone out and done some measurements on their own, but that's what people have told me they did, they extended this data set as though it were extendible. Interesting. But there are three different kinds of windstorms, one is the Chinook which we're dealing with, and one is the Bora, which is the .... the flows are very strong, further to the east and do a lot of soil erosion type of storm damage, and those tend to be in this time of year, March, April, maybe into May, you can get a rogue elephant, but most of them are in the spring or the fall. And you need a large temperature difference between the cold front that is coming in spilling over the continental divide and the lee side temperatures, so when you get a big temperature difference, that drives the Bora and causes very strong, not quite as strong as these kind of winds. In terms of erosion of soil out further to the east, I think that it would be more effective. And then the third type is the 3D wind storm, which we get here in the valley with flows from the northwest, and we get very complicated standing circulations, like the big eddy, and then embedded in that are tornado-like vortices, very small scale things that do tremendous damage. We've had week after this storm, this thing that looked exactly like a tornado came through the airport, and completely destroyed about 10 planes, and broke moorings, and did things that windstorms don't usually do. Dozens of these came through the same path, it wasn't as if a tornado and quit, they just kept coming one after another, so very interesting. But this is an unusual event, so probably what you want to concentrate on are the Bora and the Chinook.
**JW:** And you think this Jan. 7 69 was probably a Chinook?
**N:** a Chinook, and that's been documented by, Wally Brinkmann, in her thesis.
**JW:** and do you think that this, is there any explanation for this, this is the only time we saw this...
**N:** in my notes, there's a guy that ran this network for years, who was at NCAR, and my notes probably would be able to dig up his name, I keep on thinking I'll think of it, but, his job was, there were two people, one was Pat Kennedy, and my understanding is that he was quite ill a few years ago
**JW:** and he died
**N:** oh, I'm sorry to hear that, I didn't realize that. The other guy, started with van something, van

winkle, no, I can try to dig up his name from my notes, and then piled these records into a room, that's where he probably
**JW:** yeah, in just these boxes
**N:** what I was going to do was see if I could make any sense out of this thing... so if this is west.
**JW:** yes, although we're going to have to..OK, this is January 29th, Jan 30th, OK, 1500 GMT, is that right? (Sounds of charts being lined up).
**B:** so we're showing solid west plots. Does this help? We have a chart here, for the Kent station for Jan. 30th, 8 AM which we are assuming is local time, here's the NCAR chart, don't know why these are two different charts, do you remember?
**JW:** no.
**N:** These were the cooperative observer network systems, and they were given sort of more modest equipment than probably these guys had.
**B:** The kicker here is that this one is actually labeled, and during the high wind event, which probably corresponds to this, it's clearly locked in on west. Would indicate that this is, so, south?
**N:** So they go N, E, S, W, to NW.
**JW:** so it's just one…
**N:** so that would be…
**B:** so these are running at the same location but with more modest equipment?
**N:** yes.
**JW:** but this isn't at the same location?
**N:** no, it's a different location.
**JW:** quite a bit east of table mesa.
**N:** so if you presume it goes through zero…. Boy, that's strange. So zero is 315, that would make sense, because on a chart like this there would be a gap at 315. So that doesn't make sense, does it?
**B:** are you sure that we didn't have any notation on any of these charts that indicated direction? We put our own notes in there, and we're trying to remember how we came up with that direction information.
**N:** you now they still have the wind sensor at NCAR, they still have it. The lesson I think we just learned is that the scale has been changed at some point.
**JW:** your paper is later.
**N:** that was '82, that was from the NCAR … I wish we could think of something logical that's going on here, it looks like definitely….
**B:** one pattern we've definitely seen is that during high winds, the wind always seems to center up on the same location on the chart, so…
**JW:** but some of the time it's centered on the middle of….
**N:** having the flow from slightly toward the N of W would be not unusual.
**JW:** this is Dec. 5 '68.
**N:** so this is slightly south of W.
**JW:** do you think that they did, that this is 360, and this is just to catch the overshoot?
**N:** I'm just guessing, yes. It's sort of awkward if they made this 360 degrees that would put, that's 360 degrees is the flow direction here, really significantly off from what you would expect. Well, maybe not. That would put it, if they did that, it would put this, this would be W right here, so the flow would have gone to the NW, which would be a not unusual direction.
**JW:** even in the middle, you see this drop in windspeed.

**N:** wouldn't be that unusual, there's so much variable here, but it's gone over, let's see, counts, so we're right here is west, we're definitely moving over to the NW.
**JW:** this is Dec. 5th of 68. Pencil marks are mine, obviously, I was trying to ….
**N:** that's nailed, that's exactly to the W.
**B:** OK, so we had guessed right.
**JW:** I think , nope, it's a little bit further down, is it that one?
**N:** no it's somewhere…
**B:** so there's the W and…
**JW:** counts.
**N:** this is the halfway point right here on this scale, that's exactly where you have it marked on your W.
**B:** so we may have guessed right?
**N:** yes.
**JW:** OK say it again, I thought you were saying every two blocks…
**N:** to get the charts, to get the divisions, that seems to be that the divisions don't make any real, logical sense. They just found a chart, and probably the chart works for the windspeed, looks like they have it calibrated correctly for that. And when they did that, I guess this is the same chart, it didn't come out for the wind direction. That seems to be what it's saying. So that would make these (counts), that would make this particular event almost on the nose.
**JW:** on the line.
**N:** on west.
**JW:** where does, OK, I need a pencil… OK, so where, this is N, then.
**N:** right. Then this would be N again.
**JW:** so where does..
**N:** this W which is right in the middle of this chart is west.
**JW:** so that's just one 360 degree
**N:** that's apparently so, so you see all of these jitters here, are, especially with the lobes, are, at those speeds are probably flipovers. And it's just that the chart at this end probably has a bumper, so that it's not allowed to go the whole way. ….so fast it just flips over. That certainly is a reasonable interpretation.
**B:** and your interpretation that this is west, is based on other observations of wind direction.
**N:** most of the flows during these kinds of storms are centered around west.
**JW:** but the fact that this one is NW is OK with you.
**N:** the fact that this started out west, and then shifts to the NW with time, and … is perfectly…. Then it goes slightly… it's moving through the NW through the rest of the incident, although here it's highly variable back in here, but so was, there was a lot of variability in there. A flow from the NW would be…counts.. that wouldn't be that unusual.
**JW:** and to have this event completely out of the NW is OK.
**N:** not that unusual. If you look at … thesis, she has the wind vector, and she compares it with the vector from west she compares with the total vector, her, some storms, and you'll see, usually, they're west but there are some displacements.
**JW:** OK, so if I were going to go through, see, you can see what I did here, got it characterized where the middle of this is.
**N:** another healthy thing would be to go up and look at that site, and think about how everything is. You'll see upstream there is a gap, there's Green Mt. and Bear Mt., there's a gap over there, and

then you've got the building itself, and all of this in the foothills. But where you have Kent, I think you'd probably have a closer representation of the flow to your site, in this one.
**B:** JW had said that N was here and here, that doesn't make sense to me, it seems like that should be E if this is W, a 180 out.
**N:** if this is 360 degrees, it starts off at N and it ends at N.
**B:** how could W be…
**N:** so W is in the middle, oh wait, right, 0, 180 would be the center, right.
**B:**; it seems as though this would have to be E if this were a 360.
**N:** that's right.
**JW:** would they ever calibrate an anemometer to do E…
**N:** counts, see, this one ends with S. The way it was set up here.
**JW:** see, now, if this was really 360, than the middle is S, than W is somewhere in here, and then this event is from the W.
**B:** I thought we just said that he thinks that this is W, and we're just trying to find out what these are…
**N:** say it's set up the same way, but a different scale, so this, starting out N, E, S, W, N, E, S, so instead of having a 360 degree scale, you have 360 plus 180, so that would start with N, and end here with S.
**JW:** counts.
**N:** N, E, S, W, N, E, S.
**JW:** and these are straight out of the N.
**N:** and that would make the scale the same as I've got it here.
**B:** if these are from the W, where….
**N:** this would be from the N… so (counts). This would be from the N then.
**JW:** even a little bit from the NE as you get down into here.
**N:** that would be an unusual direction right in here. But.
**JW:** those are big winds.
**B:** Is this the one, the confusing wind storm, yes.
**JW:** this is the 7th.
**B:** all the rest of them.
**JW:** well, but they're not now, now I'm not.., now I don't feel that comfortable, this is from the N then…
**JW:** yet that indicates that it was probably, that Jan. 30th, if we look at this, this is the same time, 8 in the morning, and this is pegging on straight out of the west. That would indicate that this direction would be straight out of the west. Not the middle of the chart. If they're the same
**B:** if they're the same.
**JW:** Jan. 30th was our biggest sampler event. Because, in theory, it went straight into the sampler.
**N:** I don't quite know what to say, except maybe by finding the guy's name in my records that he might still be around, and he wasn't the type person that wrote on the charts, so you're not going to find a record of him.
**B:** would there be logbooks anywhere..
**N:** I was in the habit, I started running at work in the 70's, and I would frequently get some of these data if I was working up a storm, but I would always give the records back when I was finished with them. It looks like, for me, I must have been very clear at the time that this was the scale. This is a comparable storm, and it really is OK, well it's obvious that this storm was doing

some very unusual things. Rare events. And it doesn't surprise me, but it would surprise me if these winds were truly from the north.
**B:** my limited experience up in Ft. Collins is that the big winds never come from the N.
**JW:** would it make more sense if these were really both N, and W were somewhere in here?
**N:** not really, not for a couple of these. These would be southerly winds, and that would not be…. How strong did this get? Gusting to a hundred? No, that would be…
**JW:** you would expect maybe NW…
**N:** you'd expect W with a veer with time, but centered around W, and the winds changing to the NE or maybe slightly S of W, but not from the S or from the N, that would be completely unusual.
**B:** these are interesting, they're kind of similar-looking storms, same velocity here.
**JW:** completely different wind direction.
**B:** the fact that they both lock in pretty tightly on a direction, but the direction is different, is that possible?
**N:** sure, as long as this doesn't become N, this one, would not be unusual from the NE. NE is a favorite direction for high wind events
**JW:** NE?
**N:** Sorry, NW, that's a, not that unusual direction. They tend to be a little bit more complex when that happens, but, W is what is usual. There's no question about that.
**B:** OK. So your experience is that this is likely to be W and this is likely to be from the NW.
**N:** that's what I would guess.
**JW:** because if we were to say that this were from the west, these would necessarily be S of W, or almost S, and that would be pretty unusual.
**N:** so, if that's, here we are saying that this is W, this is then NW, so we have… and that would be N up here.
**JW:** just based upon the magnitude of the events at the samplers, this event and this event had huge, huge sampler readings, compared to anything else. And that would, basically the sampler we're looking at is directly east of the area where the erosion probably occurred from, that would make me feel more comfortable with this being W, and this being S of W, because this was big, but it wasn't huge, and for those wind directions to be that big, and to have it blowing right into the sampler, and to not get much at the sampler…
**B:** yes, I understand.
**N:** but now you're taking your data and having it drive the choice of directions and things..
**JW:** yes, I know.
**B:** let's line up all five of these, just for the fun of it, in some kind of order. Guess maybe date order, so we just look at the high wind parts of each. Just going to look at the….(organizing charts). (Looking for April charts.) (found 7$^{th}$ of April.)
**JW:** so guess what one looks like the anomalous one, the 5$^{th}$ of Dec. All the other ones are pegging on this low.
**B:** just limit it to the high winds.
**N:** so the only one that's different then is this one, and that one that doesn't bother me very much. This is all the same?
**JW:** this one is one, this one is one, this one is one.
**B:** these two are April.
**JW:** This one is March, this is Jan. 30$^{th}$, that one is December.

**B:** these are all Table Mesa, what do we have during these periods for something besides TM?
**JW:** this is all we have. These are all TM.
**B:** I keep asking that, is that because there wasn't anything else?
**JW:** Kent was the only other one that was even close to being a complete data set. We would have only one of the five days. Those are all W. (organizing charts).
**JW:** this is actually pretty interesting. This is the possible answer. This event here, is that one on the end, the one that's a little bit S of where we think it may be.. This one, that one on the end, this Jan. 7th, the one that goes a little bit low, and it looks like, part of that event..
**N:** well it goes to the right more than some of the others.
**JW:** that one's starting to hit on SW. That's kind of interesting, on some of those high winds.
**B:** do we have any of these for TM?
**JW:** these don't exist for Table Mesa.
**N:** you said this one is..
**JW:** that one looks like it's a little bit SW, at least at Kent it was SW.
**N:** that didn't work, I tried to assume that this was N and that this was N.
**JW:** no, it didn't work.
**N:** I'm running a class I teach student here. Water craft propelled by surface tension. (more discussion).
**N:** the guy's name was Frankhauser. He worked for NCAR, people were all doing this, sort of citizen volunteers, we provided the equipment, he was the liaison. But I'm very certain that was the guy's name. I don't know who, Joe Klemp is still over there. He's a theoretician, but he would be able to verify that the guy that took care of the network was Frankhauser. I'm very certain it is. Doug Lilly who's now down at the U of Oklahoma would be another person who has written a couple of papers with this kind of records, he might remember. Joe Klemp is here at M cubed over at NCAR.
**JW:** we talked…. (tape side ends, extended break in recording).

(Note: during this period, we compared the Table Mesa and Kent charts to each other, and decided that using Table Mesa and Kent data ratios to proportionally approximate wind speed/direction data at Kent for dates when only Table Mesa data existed would be appropriate. The Kent station is farther from the foothills and less influenced by the extremes seen next to the foothills. This data would better represent Rocky Flats conditions.)

(Tape back on):
**JW:** what of these wind speeds would be the most representative wind speed?
**N:** what we did was draw a best sort of fit to the envelope, and that includes some of these peaks, and every five minutes took the amplitude of the envelope, and then plotted that as a function of time, then I did the same thing to the eastern side, and plotted that as a function of time, and then took the ratios of these throughout the event, and you sort of got a picture of how the relative wind speeds were for the two different kinds of events. To look at a Bora, that's how I did it. These tend to be fairly extreme, and they're probably representing some localized eddy or surge, amazingly strong 3D effects that occur here.
**JW:** and a better representation of the wind would be to do this, rather than something down the middle, that wouldn't be representative?
**N:** I don't think so, no. You're faced with this, and I'd just take the envelope, and not allow

yourself to be influenced by these very extreme short period gusts. Actually, if you're comparing further from the foothills, this is more like, it doesn't show all the gusts, very little vorticity.
**JW:** and cut that kind of stuff out, too.
**N:** yes.
**B:** so what you're saying is this is probably influenced by the shape of the hills.
**N:** a lot of vorticity, eddies, so the short, all of the damage gets done by the vortices which are embedded in the mean flow which is strong enough. I'm sorry there's not any more time to really get into this further, but we spent a lot of time doing experiments on this down here, and there's a pile of stuff, but I think you got probably the best guidance I have.
**B:** and you're not aware of another data set that might better approximate Rocky Flats?
**N:** just finding the Rocky Flats data would be the thing to do.
**B:** we haven't given up. Other than that, this, Kent probably is the most appropriate.
**N:** as I say, Whiteman may have gotten his hands on that at one point, other people sporadically throughout the years have studied Rocky Flats.
**B:** We can track several different people who have had their hands on the box, including the facilitator, Reed Hodgins, someone had it in their closet for awhile, it's like a mystery novel.
**N:** keep up the good work, maybe you'll get it yet. I'm sorry I couldn't spend more time. I thought, gee, we'll be able to figure it out, I'm really not all that clear, and I think doing that comparison is really (the best)…
**B:** well the best thing about this is that it's really the data set that we want, and their isn't any doubt there as far as wind direction
**N:** that has helped quite a bit, actually.
**N:** now that I know what you're trying to do, if I think of something or find something in your records, but, I think remembering that guy's name was the most… Thanks.
(Tape ends)

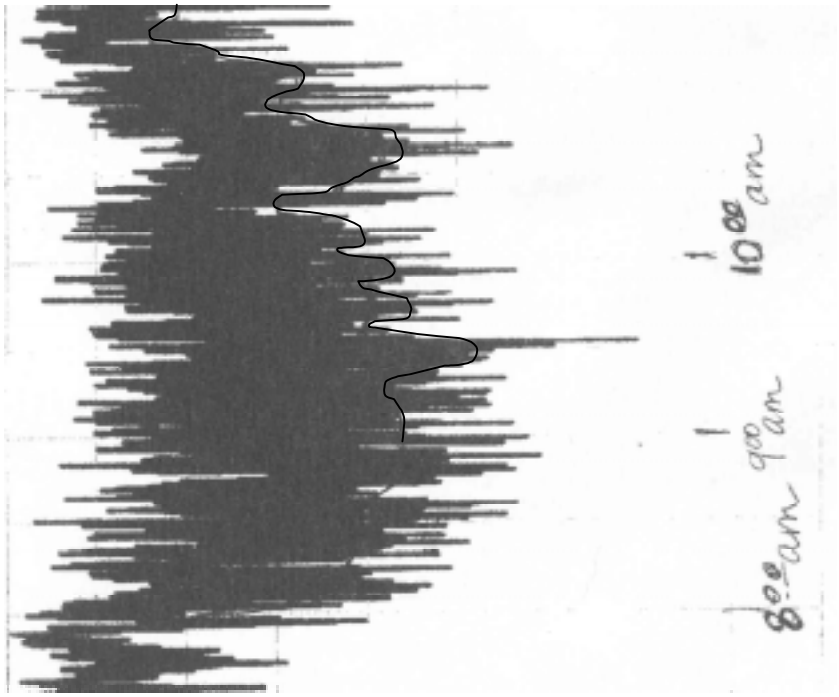
## Follow-up letter to Dr. Bedard

June 15, 1998

Dr. Bedard-

Thank you for agreeing to meet with us again to discuss remaining issues regarding the NCAR wind charts and our representation of wind speed. We appreciate your cooperation, and your assistance has already proven helpful. We have two major remaining issues, discussed below. The first regards our assessment of wind speed using the NCAR data, and the second involves two different uses of these wind speeds in our research.

Below please find a scanned version of one of the wind charts that we showed you during our April meeting. During that meeting, we discussed the way to best represent the average wind speed during a small increment of time. You suggested to us that we draw a line which followed what we have come to call the "valleys of the peaks," or some estimate which does not give as much weight to the short bursts of wind that are represented on the chart. Our interpretation of this advice was that these bursts are usually quite short and tend to not represent the movement of the wind cell very well. This figure attempts to represent how we interpreted your recommendations.




When we showed this figure to the panel that oversees our work at Rocky Flats they were concerned about the process used to define the approximated line, calling it an "unscientific" approach. We tried to explain to them that it was based upon a great deal of evidence collected over years by people who work with wind every day. That seemed to not appease them. We were hoping you could review what we did and assess its validity. At our next discussion, we are

hoping we can talk more about the evidence that suggests that an evaluation like this is valid considering the data we have to work with.

Another problem that we have been considering is the difference to us between wind speeds that we would use to predict "suspension" and "dispersion." Suspension, as we are sure you well know, is the process by which material on the ground is moved into the air stream. The rate at which suspension occurs is a power function of the wind speed. The power to which the wind speed is raised has been the subject of some debate, but a best estimate for Rocky Flats conditions appears to be about 4, such that:

$$R_s = X\left(\frac{u}{u_t}\right)^4$$

where
$R_s$ = suspension rate (g $m^{-2}$ $s^{-2}$)
$X$ = constant (g $m^{-2}$ $s^{-2}$)
$u$ = wind speed (m $s^{-1}$)
$u_t$ = threshold wind speed below which suspension does not occur (m $s^{-1}$).

Because of the nature of the power function, a small increase in wind speed has a very strong impact on the suspension rate. As a result of this dependence, it is desirable to represent wind speeds in the fashion that is described above, where higher wind speeds tend to dominate the "average."

Dispersion is the process by which material is transported by advection and turbulent diffusion. The nature of winds on the Front Range tend to indicate that wind speeds further east of the foothills are not as strong as those in close proximity to the mountains. Because transport tends in that direction, we need to rethink the wind speed that we will use to represent the above chart in dispersion calculations. We are hoping that you can help us think this out, based upon your knowledge of winds at the Front Range.

The speed at which the wind cell moves through the area will dictate the movement of materials once they have been suspended. Whether this speed is well represented by the technique described by the above figure is a question that we have. Would a true average of the wind speed represented by the chart over a given increment of time be better?

These issues are some of the bigger ones that remain for us to solve. We are hoping that we can utilize your expertise in this area to guide us into making justifiably sound decisions about how we handle these problems.

We appreciate your assistance and look forward to our coming meeting.

Sincerely,

Jill M. Weber
H. Robert Meyer,
Consultants to *Radiological Assessments Corporation*

## Notes from Second Conversation with Dr. Bedard

Conversation with Al Bedard
7/2/98
Bob Meyer, Jill Weber

In reference to our question about the characterization of maximum wind speeds, removing the minor gust events…

- In his own experiments, he has made plots from digitized data of maximum wind gusts in 30 second periods. In these digitization exercises, he does his best to get rid of inconsistencies
- Given our lack of detailed time series data (would have to hand-define the time, and this is a very unquantified process) he would have done the same thing that we did – identifying the maximum winds.
- The short bursts are usually some sort of eddy effect – within 20 to 30 feet they will have lost their coherency and broken down. These short bursts are more frequent at the Front Range locations and are rarely seen at locations as far removed from the mountains as Rocky Flats.
- Even the Kent data support this – when you compare the gustiness of the two sets of wind charts (Kent – Table Mesa) you see much more continuity in the Kent charts and fewer of these high burst, minor eddy effects.
- He thinks that given the location of Rocky Flats, the lack of time series data, and the quality of the wind records we have to work with, he would not have done anything differently from the way we did the wind speed quantification.
- Asked him about the presence of digitization schemes to characterize the envelope we are trying to discern –-he was not aware of anything like this, and suspected that none existed because anemometers have been digitized for some time – not as much use for older wind charts, so no need for such a digitization scheme.
- Suggested we might call the weather service in Ashville, NC to ask them if they were aware of any companies who might do this.
- One way to prove our methodology might be to obtain time series data from the Solar Research Institute – part of Rocky Flats/DOE. We could play with this data and characterize it our way and the way Dr. Bedard has done for his digitized information.

With regard to our question about suspension vs. dispersion wind speeds

- His experience on the front range is that there is usually so much more going on than just how fast the wind is blowing.
- His experience is that pressure stresses are greater for mean flows with gustiness (? – don't know exactly what this means…)

4 possible types of effects on dispersion

- Bora event – acts a little like a thunderstorm – has a leading edge discontinuity – flows at leading edge are much greater than the terminal velocity - makes it very effective at suspension and dispersion, would probably mix particulates well, but would disperse them as a concentrated unit.
- Vertical axis eddies – efficient at suspension – would be good at dispersion, but mostly vertically – would not remain coherent as long as a bora event would
- Lee wave – interacts with the surface and produces a giant column of dust (good picture in the book Clouds of the World) – can pull up a lot of matter and disperse it quite widely – a much less concentrated dispersion than a bora.
- Flow along the surface with a reversal at low levels – this will carry dust up and back into the top flow, which on the front range is the west to east flow. The reversal creates a region of

enhanced suspension, and the placement of the dust into the west to east flow creates a good opportunity for dispersion.

His suggestion is to:

- Characterize the wind events as best we can, and try to place them in one of the four above categories (all of which are good at suspension and dispersion) or not in any of these categories, which might be an ineffective wind event.
- We should use the information that we have (with limited meteorology) and compare it to existing data and/or information for a research meteorologist who understands flows. Some of this information is on his web site, and some might be gotten through conversations with CSU and person there named Cermack.
- This type of methodology might prove more helpful in characterizing each event as one that would be good at dispersion or bad at it, rather than just relying on an empirical model.