DRUG TESTING ADVISORY BOARD

Open Session

September 7, 2005

Agenda Item: Welcome/Opening Remarks

MR. STEPHENSON: Welcome to the Drug Testing Advisory Board. This is an open session. There will be an opportunity for the public to make comments at the end of the session today.

I apologize to you. The agenda that we had prepared previously had not been extended, but we have additional information that has become available that we wanted to share with you today. And that will be done as part of our HHS updates.

Any individual who wishes to make a public comment, please let a representative know so that we can divide the time equally among those who want to make comments.

I would like to also acknowledge that we have a lot of our staff and a lot of our people that have family and friends and others, businesses, that have been impacted by Hurricane Katrina and the aftermath, and our hearts, minds, thoughts, good wishes are with all of them. We have an ongoing operation center that has been set up in HHS and in our own agency to deal with some of these issues, and we've been staffing it around the clock, and will continue to do so, we think, for some indefinite time into the future.

But if there is anything you have that I can be a conduit back to that process for, see me at the break and I'll be glad to see what I can do to pass things along for you.

At this time on the HHS updates, we are not side stepping things regarding the guidelines, but they are in internal clearance, and there is nothing else that we can say at this point about them. There is some information that will be highly relevant to the public, to the industry, to laboratories, and other interested parties about what we have learned, and our abilities to perform certain kinds of tests, and to demonstrate proficiency challenges.

Agenda Item: NLCP Pilot PT Program for Oral Fluids

Note: The PowerPoint slides for the following presentation are attached at the end of the transcript.

DR. MITCHELL (RTI International): This morning I would like to take some time and go over some of the results that we have gotten from the PT programs with alternate matrices, since alternate matrices is one of the big topics in our system, or within the NLCP.

This is a retrospective review of what we have learned. That is what I am trying to present this morning at this point in time. I think there will be certain things that will come out in this that will give you an idea of where we actually stand as far as a

program, and its ability to provide quality control or quality assurance challenges to these laboratories.

Slide 1 and Slide 2

I would like to start with oral fluids and some information that we have obtained to date. Even though this is not all the information, I will give you what I do have. We will be going over, just for review, the initiatives that HHS has had over the years, and how long this has been ongoing. We will go over the state of the PT programs, and then last of all, the lessons that we have learned as a program about testing and oral fluids.

Slide 3

If you remember, this whole thing started with a series of public meetings in which the industry and scientists were brought in to advise HHS, and for HHS to try to determine what was the state of the science, and the state of the industry at that point in time. That started in April 1997.

That eventually came into working groups, which were formed at the request of HHS to advise them, or at least to give them some information concerning what was needed in order to put a particular matrix into workplace drug testing programs. Shortly after these working groups had meetings, we began the PT for hair, oral fluid, and sweat in April 2000. And now we have had the proposed revisions to the mandatory guidelines published on April 13, 2004.

Slide 4

In the PT program for oral fluid, we have had actually I believe it is three phases that we're in right now. And one phase led to the others. The first phase was three cycles, which began in 2000. The purpose of these was to assess the ability of the labs which were doing oral fluid testing, to meet some type of standardized criteria; also to determine what those criteria should be. Were they appropriate or were they not? Also to determine whether or not as a program, it was going to be possible for the Federal government to provide quality assurance samples that would test the ability of the laboratories to meet certain standards.

In these cycles, the issues that we identified were the testing variability, that is, how much variability we had; the stability of the analytes in the PT samples, which was a problem for us, and one of the other things that we found in this first round was issues associated with the collection devices that were currently being used in the industry.

Slide 5

One of the ways we have used throughout this program to try to get an idea of how the lab or how the industry is performing was to look at what we call the coefficient of variation or CV. The coefficient of variation is just a way of measuring how the results coming in is between all the laboratories, not within the laboratory, not its variability, but between the whole system.

Of course, the problem with this is that CVs can be affected pretty drastically by one or two laboratories which are very poor performers. In other words,

you can have a core group of labs that are doing pretty good, but if you've got a couple that are just coming in and learning the system, and learning how to do the testing, and their variability is great, it is going to cause these overall variations to be fairly large.

In this slide, we have the coefficient of variation as a percent. We have the analytes, beginning with amphetamine, methamphetamine, benzoylecgonine, morphine, 6-AM, codeine, PCP, and THC. As you know, currently we are looking at the parent compound in oral fluid. We are looking for tetrahydrocannabinol.

Slide 6

To put this into proper perspective, what we saw in cycles 1 and 2, I thought it would be a good idea at that time to look at the performance of urine at that point in time, and also urine when it first began. For example, we have data from the pilot PT program in urine that was begun in 1986, and that is designated by these dark red bars, which looks again at the coefficient of variation.

We also have for urine what is currently being obtained for these analytes in the NLCP program. And you can see these dark blue bars are very low. The variation, the CV, is somewhere down around 10 percent of the mean value obtained from the group.

And then just to put it in perspective, we looked at hair, which is in the vanilla color, and then this light green, which is oral fluid. I realize we are talking about oral fluid, but I think this comparison will give us an idea of where we all stand.

If you just focus on the pilot PT programs, that is urine, hair, and oral fluid, let's look at them in perspective. What we see is that many times the variation we saw in the urine, in the pre- or the pilot program was equal to or greater than that we are currently seeing in both hair and oral fluid.

That puts it, I think, in the proper perspective, because we know that with that meager beginning, we now have laboratories which are under this program, which are performing at a much, more precise manner and uniform manner throughout the system.

Slide 7

Remember I was talking about when you have a couple of labs that are giving you some pretty bad results. If you remove those results from the system, you start seeing that in oral fluid overall, we are looking somewhere between 20-30 percent variation, except 6-acetylmorphine in these first two cycles.

Probably the main reason for that is most of the laboratories were not testing for 6-acetylmorphine at that point in time, and so this was a new analyte. They still had to get their systems validated, find out where they were relative to everybody. It is a means of learning. And that also is one of the important parts of this program, was to allow the industries to learn what it was like to have their results judged against another laboratory. That brings about standardization within itself.

Slide 8

Cycle 3, because of what we were seeing, we had some questions about what was affecting the variability that we were seeing. Why was it happening? So we set up a group of samples for a single cycle, about 20 samples, which had analyte

concentrations going from one-half of the proposed cutoffs to about two to three times the proposed cutoffs. This is what we would call the dynamic range. How well were the labs being able to quantify within this area?

Some people would say, why do we need to quantify? That is a whole different story, but in our PT program identification in itself is not enough, because a laboratory may be able to identify two samples which have say benzoylecgonine, the metabolite of cocaine in it, but in the process of doing this analysis, they could have switched them. If you do not know what the concentrations were, if we put no reliability, then we cannot look at the internal workings within the laboratory to see if they are maintaining specimen identity throughout the process. That is why quantitation is very important in this program, because if the concentration that a lab gets is 50 percent off or 100 percent off, you do not know if you are only looking at identification, whether or not they are even testing the correct sample. That is why it is very important.

One of the other issues, we know that THC, tetrahydrocannabinol, which is one of the active ingredients in our society's most favorite abused drug, marijuana, has some unique properties compared to some of the other analytes that we are looking at. And in non-scientific terms, it is sticky. That is, it sticks to everything. And it is very difficult to release from surfaces.

We found that out early in the urine program, when we were developing the collection devices for urine. In fact, if those that have been around long enough to remember that with urine, even the insert in the cap of the urine bottle could absorb the THC metabolite, and the concentrations would go down. There was a big push initially, and this has continued within the industry, that the providers in the industry must make sure that their collection devices do not absorb the marijuana metabolite.

Most of these devices have some type of absorbent material. We wanted to see what was the effect of these on variability. When we sent the laboratories the samples, they were neat, spiked oral fluid. In other words, it was spit that had drugs put in it and sent to the laboratory in nice little vials.

What we asked them to do in this cycle was to analyze it neat, that is without just taking it out of the bottle. And then the other one was to spike it onto their collection device, a specific amount onto their collection device, and then proceed as if it was a real sample.

Slide 9

Looking at the variation, we have again the CV over here. The blue is the neat sample. And this is the sample that was placed onto the device. One of the things you will note is that for some of these we have very few labs reporting values. But overall, what we see is the results were fairly good.

In some cases, the methamphetamine, the CV was higher with the neat than it was with the device. And then with others, like 6-acetylmorphine, we saw that the variation was less with neat than it was with device. BZE, morphine, and THC had fairly high CVs compared to the other analytes in this particular cycle.

Now, the BZE, this is the metabolite of cocaine, one of the reasons for this variation, I'll just give it to you right now, is that we had some labs that were only testing for benzoylecgonine, and they didn't worry about cocaine being present. They were hydrolyzing cocaine in their procedure to BZE, and so they gave you some high

variability with this particular analyte. Morphine though, and THC, we couldn't easily explain why we had the large variability between the device and the neat material.

Slide 10

In this particular cycle, what we did was we looked at one specific device, and tried to see what we could see with THC. And what we see is that at every concentration, the THC concentration in nanograms per mL, the THC concentration in the device was less than that in the neat fluid at every concentration. This indicated that we were seeing some problems with the actual absorbent material on the device, and we did some further things a little bit later. That pretty well explained our THC issue.

Slide 11

The next phase was a phase in which we designed it to look at the inter-, that is between laboratory variation, intra-laboratory variation to see how well the laboratories were able to by inter, that is the variance between them, and then intra, being able to determine if the laboratory analyzed the same sample over time, what was the variability that we would see. Some of the issues identified in this was testing variability again, and analyte stability. I will cover these in the next slides.

Slide 12

As I said before, the human oral fluid was spiked similar to cycle 3. The complete set of samples was sent to the laboratories three times over about a three month period. And the laboratories received no feedback during this time. The idea for that was that they would not go through and change their procedures, because each time we provide results, we encourage the laboratories to look at the results, and to go back and make appropriate changes in their methodologies if they feel that it is necessary.

Slide 13

Looking at the intra-, that is the variation within lab, mostly we see with the variation is that the ability of the labs to measure a sample time and time again is pretty good, especially with the amphetamines, where we expect very little matrix, or any other type of effect on the analyte itself. We found that in these particular analytes, that as I said, the within lab variation was less than the variation between labs.

With morphine we found that the variation within the lab was actually greater than the variation between labs, and you say, how can this be? I think we have some results that will show us both that and for 6-AM. Cocaine, again, we are looking at variation here, where the within lab is fairly good. The between labs is not that good. Again, we are dealing with that variation where the cocaine is potentially being hydrolyzed.

THC, the one that is a problem, we can see that we have very high variation within the labs, and we have very high variation between the labs. Let's look at some of these parameters a little bit closer in the next slides.

Slide 14

The stability of morphine. The main thing I want you to get from this is that when we look at the concentration of morphine from cycle 4, cycle 5, and cycle 6,

we see the concentration decreases. That is a matter of stability of the analyte in these samples. This was seen to some extent in the lower concentrations.

The thing that surprised me was that the change in the lower concentrations was less than what we saw in the higher concentrations. I still don't understand that. But it indicated that there needed to be some way to stabilize the concentration of morphine. In an attempt to do that, we have looked at using sodium bisulfite, which is commonly used in pharmaceutical morphine preparations to stabilize the analyte.

Slide 15

With 6-acetylmorphine we are seeing the same type of thing. We believe that this again is the stability, and we need to add a stabilizer, and so we have utilized sodium bisulfide also in this particular situation.

The main thing I wanted to show was that for some labs in which variation was the same no matter what the concentration. There were also some labs which were very high, and it remained about the same. And then we saw some in which there was a decrease in the variation as the concentration went up.

Slide 16

There was some high variability that we really could not account for with the 6-acetylmorphine that would give us a real handle on what was happening in the laboratories. It was just trying to show you the complexity of trying to analyze what's going on in the laboratories. The patterns do not always make sense.

Slide 17

With THC, we see that the concentration decreased with time in cycles 4, 5, and 6, which is what we would have expected because of the problems that we had.

Slide 18

To try to evaluate THC and morphine, we designed some samples that were being sent out. These began in December last year, and we have just completed the last of these cycles. I am going to present some of the data from the December cycle, which is relevant to what we are talking about.

We not only wanted to look at THC, but also we wanted to look at the ability of laboratories to test for the THC metabolite, 9-carboxy-THC. The reason for this is that there have been some reports that this metabolite is found in oral fluid.

If you have a metabolite which cannot be produced except by processing through the body, that is more convincing as evidence than if you are using the parent metabolite, and then you have to make sure that there are other things that are not affecting the possibility of it being in the particular matrix. Again, we wanted to look at the morphine and 6-acetylmorphine. As I said, this is still in analysis for cycles 8 and 9 and some of 7 continue.

Slide 19

One of the big things that we looked at again was what is the affect of the spiking device, as well as the liquid in which the device is put into on the THC. We are

looking at the percent of recovery from the device, or from the amount that was put in. We have in the blue, we did the spiking on these samples. We spiked a specific amount of oral fluid, which is oral fluid spiked with THC onto the pad, and then placed the pad into the diluent that the manufacturer provides for that specific device.

In this one we spike the diluent that the manufacturer provides with the THC. Then we placed the device with the pad into that diluent. Of course, the last one is just the diluent spiked without the device, which has the absorbent pad on it.

As you can see, without the pad the concentration was always greater than it was when the diluent was spiked and the pad was placed in it, as well as when we spike the pad. There are still some differences, but it does not appear to be as great as what we had seen in cycles 4, 5, and 6.

Slide 20

Now, we also had in this process, we had two different diluents that were being used from manufacturers. We wanted to look at how these diluents compared to one another. You can see that one diluent gave us a little better recovery than if it was put onto the pad, or in this case even neat.

This was something that we needed to know, is that we also have a matrix effect when we try to use human oral fluid. Recovery of THC from that fluid is not as good as it would be if we take the fluid, put it into a diluent, and then extract it from the diluent, rather than directly from the neat fluid. Probably several different things are going on here. It seemed that we got better stability with diluents.

Slide 21

We had three different devices that were being used, that is absorbent pads. We wanted to see what was the recovery from each of those. Unfortunately, two of the pads gave us fairly low numbers, and so these means do not mean a lot. But, overall it would appear that one performed a little bit better than the other, but you can't say that absolutely. It was just because of the low numbers of labs we had participating with the other two devices.

Slide 22

What type of lessons have we learned? Human oral fluid is pretty difficult to use in a QA/QC program. There obvious difficulties -- trying to collect volumes to produce the samples that should go in what you send out. We had Dale Hart, which is one of our staff, and he was our spitting man. He sat at his desk working and spitting into a container. But you couldn't wait. You had to keep the container on ice. And you had to take it and freeze it at various intervals, or as we all know, spit begins to smell after a while, because of the bacteria operating on the food and everything, even though Dale brushed his teeth before he began each time. It was very difficult. Presently, it is not that practical.

We looked at ways, well, could we just collect all of the oral fluid, and then do some type of treatment on it such as trying to filter it through a filter that would remove most of the bacteria like to 0.2 micron, which you cannot put it through a 0.2 micron because of mucusants which are in the oral fluid. It just stops up your filter.

We did find that we could use freeze/thaw cycles which would precipitate

some of the protein and make it a little bit less viscous, but even then we still could not get it through a 0.2 micron filter. It could not be easily filter sterilized. We were running some experiments looking at the possibility of using sterilization using radiation, and that proved to be just too expensive. Also, it changes the properties somewhat, because of the high heats that are generated during that. It changed the properties of the oral fluids, so it was not a practical way to do it.

One of the things I did talk about, the dilution of oral fluids with diluents seems to increase stability and ease of production of QA/QC products. We have not made the final determination on where we are going with that at this point in time. We do not have the formulas that the manufacturers are using, so until we make a decision at some point in time where we are going, we will have to consider that as one possibility.

Slide 23

And as I previous talked, morphine and 6-AM need to stabilized with antioxidant and commonly sodium bisulfite is used. We found that we could stabilize the THC by adding BSA to these solutions.

It is very difficult to look at cocaine concentrations in oral fluid just as it is in hair, and we will talk about that a little bit later, because of the hydrolysis of the cocaine to benzoylecgonine and ecgonine methylester, as well as ecgonine. At pHs around 7 and higher, you start seeing hydrolysis of cocaine down to these other compounds.

If you work with oral fluids, we have to make sure that it is always stored at -20 degrees if we have any type of long-term storage, which brings up an issue, as you well know, about trying to sample, use neat oral fluid as a collection method. Then you run into the problems of degradation of the sample and loss of analytes over time with neat fluid without some type of stabilizing agent.

If we use neat oral fluid, samples have to be analyzed soon after thawing. One of the things that we know, and it continues to be reinforced by this is that we do need the current external QA/QC samples to establish and maintain the laboratory quantitative performance, which is essential to looking at the processes of the laboratories.

Agenda Item: NLCP Pilot PT Program for Hair Cycle 8

Note: The PowerPoint slides for the following presentation are attached at the end of the transcript.

DR. MITCHELL: I would like to present an update on the hair PT, on some of the more recent PT cycles that we have had.

Slide 1

One of the nice things, as you see with this hair work is that we have been able to get Dr. Jeri Rapero-Miller to join our staff. Jeri was with the North Carolina Medical Examiner's Office.

And so, she is working with hair. She did her research in these types of matrices for her PhD. It's been a welcome relief to me to have her there to carry out

things that I haven't been able to do. And Jeri was the primary person that put this together today for this presentation.

Cycle 8 -- we have been through 7 cycles and this was number 8. I wanted to give an update on where we are. We are currently in the process, and have completed the process of producing new samples for some additional cycles, which will begin in the near future.

Slide 2

Of course, HHS funds all of this, and for those laboratories who participate both in the hair and oral fluid, for which there are not many PT programs, they can thank HHS for their endeavors in this area. We thank them, because it gives us the chance for a scientific challenge. It is very stimulating and is a welcome relief from what we sometimes think is very mundane urine, but it does not always remain that way. The success in this effort, we have to remember Meredith, who is on our staff, and Andy, both of which have been essential to the spiking process, and the processing of the hair samples.

Slide 3

Cycle 8, again, we wanted to look at inter- and intra-laboratory performance. We wanted to evaluate analyte stability in hair a year after it has been produced. BPR is batch production record. Whenever we make the samples, before we ever begin producing it, we set up records which will record every step and everything that we do in the production process. We just call it BPR as a short term. If you see that later on, you will know what it means.

We wanted to look at what have the laboratories done to improve their performance. Have these been successful? Also, we wanted to evaluate laboratory performance on the liquid spiking of solutions. You may not remember, the last cycle, cycle 7 that we did, we had sent a liquid sample out with it which allowed us as the program, and also the laboratories to look at how they compared to other laboratories as far as their calibrators and controls. How accurate were they? Because we are dealing with just a liquid solution, it is much easier to analyze than a solid matrix such as hair.

Slide 4

In this cycle, we had 9 labs participating, 5 which have continuous participation throughout the program from the beginning, 2 which had dropped out and then returned, and we have 2 new laboratories that participated in this cycle.

We began by requesting if they wanted to participate in the PT program, to provide us some information about their test, and we finally got that in January, and were able to ship these samples also toward the last of January.

Slide 5

To give you some idea of where we are in hair testing, and I think this is an excellent slide, one of the problems that we have had throughout this process has been sensitive. How much sample is going to be required in order for a laboratory to conduct a test?

In the previous cycles, we had people that we were sending 100

milligrams, and we people that were calling us wanting more. We kind of eliminated those because we only sent out 50 milligrams this time. That's it. You only get 50. You can either use that or you just cannot participate, because that is unrealistic from a workplace program. We can't take 500 milligrams of hair off somebody's head -- some people don't have it -- to donate. And with other individuals it would be cosmetic problem. I mean it could cause some serious problems in using this.

Now what we see is that we had two labs that have not been able to get their procedures down below 50 milligrams, but we have one which is using 10 for all the analytes, and we have another one which is using 10 for most of the analytes, and 20 for THCA. And most of the other labs are at 20. This is a result of increased awareness of what's necessary, and getting the instrumentation that is necessary to have that type of sensitivity.

We also see there has been in the past two to three years quite a few papers come out about environmental contamination of hair, and the general consensus that you are going to have to do some type of wash. The question beyond that is how effective is the wash, but we are not going to deal with that in this presentation. You can see that all but one of the laboratories is now doing a pre-treatment wash to try to remove environmental contamination.

Another issue associated with the sensitivity was that we felt having worked with powdered hair, powdered hair is a process that is not very good at conserving sample. If you have ever looked at that, there is some type of ball that is used to shake in a container, and you get caking of hair on the side of the containers, as well as on the balls according to what the balls are, whether they are metal or whether they are ceramic. If they are ceramic you can end up with dust from the ceramic ball thought to be part of the hair process.

And what we see is that we now only have 3 labs that continue to powder hair, and we also see an increase in the number of labs that are doing some type of pre-digestion of the hair, whether it be a chemical or enzymatic hydrolysis or digestion, I don't know.

Slide 6

Another interesting thing is about the cutoffs. Are the laboratories able to meet the current cutoffs provided by or proposed by HHS? For most of the analytes, we find that all of the labs, LOQ, met the proposed cutoffs. We found that for cocaethylene, which is one of the proposed metabolites, 9 of the laboratories were able to meet that cutoff.

For the THCA we find only 6 of the 10 labs were able or said that they could meet the cutoff. We had 2 labs which had cutoffs higher, and we had 2 labs which did not analyze at all for THCA.

MDA, which is one of the synthetic amphetamine analogues, six of the labs could meet the cutoff. And for norcocaine, which is a proposed metabolite to be analyzed for cocaine, we only have 4 labs were able to meet the cutoff. The other 6 were not testing at all for norcocaine.

Slide 7

For cycle 8, we selected samples that were previously used in cycles 5-7,

composed of 12 spiked hair samples and 4 liquid solutions. And we finally received -- remember, we sent this out in January -- we finally received the last results on March 4, 2005. That has been one of the issues with running this program, especially for hair, it takes a long time to get the results back from the participating laboratories.

Slide 8

The concentrations between a half and three times the cutoff, we asked for confirmatory testing only, and a listing of all the analytes that we have; considerably more analytes than we have been putting in oral fluid and urine.

Slide 9

We asked that the results be returned to us within 10 working days, so we did not meet that goal. We did send final reports for this cycle to the laboratories, which included the reference or concentration in picograms per milligram, the result reported by the lab that the report went to, as well as mean concentration of all of the participating laboratories.

Slide 10 and Slide 11

Essentially, we had two concentrations, one, somewhere around the cutoff, and one higher than the cutoff that we were looking at, except for PCP. And I believe PCP was the only one that we only had -- no BE -- one concentration.

Slide 12

Looking at the values obtained by the laboratories, at the bottom we have the analyte, which in this case is amphetamine. This is the concentration, 275 picograms per milligram, and we had two different concentrations, one in this case below the cutoff, and one about twice the cutoff, between 2 and 3 times the cutoff.

You can see the variability of the results reported by the laboratories are highly variable at all of the concentrations. But we had some new labs, and some labs come back in, so this is not just the five that have been continuous. We have not done an analysis yet of the five continuous labs, and how their performance compared to previous cycles.

Slide 13

With methamphetamine we saw a very similar pattern, high variability between the laboratories as far as concentrations.

Slide 14

With MDMA we see some laboratories that are very limited in their ability to detect or to quantitate MDMA at the cutoff, so that indicates some problems there, as well as the high variability that we see between the labs.

Slide 15

I'm just going to go through these, just to give you a visual picture of what the analytes were like. MDA, which is a metabolite of MDMA, the same type of pattern.

Slide 16

MDEA, remember there were very few labs that tested for this, and so we have the same type of issue.

Slide 17

Cocaine, we see some high variability, as we would expect. As you are getting the flavor, we still do not have a uniform population in their ability to detect the analytes and get them out of this hair matrix, which is not an easy process.

Slide 18

Benzoylecgonine, not quite as bad, but still we do have a good deal of variation.

Slide 19

Norcocaine, of course there were very few labs that were -- I think there were 4 labs that were looking at norcocaine. The results were variable.

Slide 20

Cocaethylene was kind of interesting in that this to me, was a little bit better than I had seen with the other analytes in that if we you look here, the variability is somewhat reduced for cocaethylene. I don't know why, but it is.

Slide 21

Morphine is highly variable. You can see the results that we go all over the place.

Slide 22

Codeine is the same story.

Slide 23

With 6-acetylmorphine it seemed like we had two populations kind of high, and then another one right in here, but still it was highly variable.

Slide 24

PCP was not too bad, but PCP tends to be a fairly easy analyte to analyze for.

Slide 25

THC, you can see that we are all over the place with -- well, this is THCA, this is the metabolite. And we have only 4 labs that are analyzing for it, and we do have a problem at the lower end, which 0.05 was the last proposed cutoff concentration that we had or was in the guidelines.

Slide 26

When we look at the mean coefficients, we can see that overall only CE has a fairly decent coefficient variation. All the others were 20 percent or higher in this

population.

Slide 27

Let's see how it is going to look right at the cutoff. What is the variability at the cutoff rather than over all the concentrations? We see very little difference. The variability is there.

Slide 28

Other than the conclusions that we gathered that I have previously talked about, one of the things for us as a program is what are the problems in producing these samples? When we produce the samples, this is a solid matrix. You have hair, and you try to spike the analyte to get the analyte to go into the hair.

Can we predict that process? Can we say, okay if we put it in a solution containing so many nanograms per mL of say cocaine, what is going to be the result of that concentration in the hair in picograms per milligram? We began this process. When you look at the incorporation of analyte into hair, you do see a linear response within certain time periods. Early on there were times when we just did not know what was going on because what we predicted the concentration would be, it was totally out to lunch.

But looking at that, agreement with the BPR target, that is our prediction, it was still highly variable. Six of the analytes were within plus or minus 20 percent, which I thought was pretty good, especially when you are shooting in the dark. The ones with the greatest variability where the 6-AM at 75 percent and norcocaine at 100 percent. That was a fairly new analyte, and we are still working on it.

This is just to indicate if you are using this target concentration to judge the labs, how many of the labs would be within plus or minus 20 percent. And you see that it's not very good. We are not there yet, either from a PT standpoint of being able to predict what is in the hair, as well as to get the laboratories which are sufficiently standardized, that we will get the results within plus or minus 20 percent of the value.

Slide 29

Again, overall agreement among the laboratories was not evident. The CVs range from 17 percent up to 78 percent. The drugs having the most discrepancies were opiates and THC. Where we did we see it in oral fluid? I think it was in opiates and THC, and this is because of the type of compounds they are. And the big one for us as the producer of the samples is the predictive incorporation of the drug in the hair remains a challenge.

MS. GORDON (Board member): John, our last slide when the reported concentrations are plus or minus 20, just out of curiosity, was there any one lab that was within that range for all analytes, or more than one lab? Or were they all kind of mixed matched, they got some right and some wrong?

DR. MITCHELL: I am thinking about how to answer that question. I think rather than look at that, because that slide is talking about this from a guess point, if we look at certain laboratories, you can see that the intra, that is within lab variation within some

labs is much less than it is for other labs.

There are 2 or 3 laboratories out there that are fairly tight in their intra-variation, but there are others that are all over the place. Yes, we do have 2 or 3 laboratories that do provide consistent results. That is not necessarily that all of them are always in agreement with one another, but within themselves they are in agreement, which indicates at least quality control within that laboratory, and validation of their procedures. We just have to find out what the commonality is going to be to bring them all to the same answer.

MR. STEPHENSON: The value of doing this presentation in the open session was to share in a timely manner, that learning opportunity for a number of interested parties. John, have the hair labs received the information on this cycle?

DR. MITCHELL: For hair, I believe it has gone out.

MR. STEPHENSON: So there is an opportunity for the industry to learn from this. And it is an important thing for people to realize when they are doing things well and it's tight. It is also an important thing to know when there are still challenges out there that you need to face inside your own lab. And that is a part of what this process has been about. It has cost a lot of money, it has taken a lot of time. It has been a challenge.

And as you said, paraphrasing your last bullet, both shooting in the dark and being out to lunch are still issues that scientifically are in front of us in developing some of these PT cycles.

Agenda Item: Department of Transportation Update

MR. ELLIS (DOT): As you are well aware, DOT, especially at the secretary's level is pretty focused on the hurricane, and we want to express our best wishes to our friends and colleagues in the affected areas, including Kroll Laboratories, which is one of our partners in our DOT testing process. And we are happy that Pat indicated that all her family is okay, and appreciative of that.

As you know, our office is responsible for 49 CFR Part 40, which is the portion of the DOT regulations which govern the collection of specimens, laboratory analysis, medical review office, and the substance abuse professional for returning individuals who fail our tests back to covered service.

We are also responsible for assisting the DOT agencies, the Federal Aviation Administration, the Federal Railroad, Federal Transit and others in the implementation of their regulations which govern the testing of approximately 12 million people throughout the country, regulated employees.

Our office is also responsible for foreign issues and also advising the secretary on all drug and alcohol matters that come before him.

A couple of items to update you in terms of what is happening at DOT, is as you know, we have been wrestling with our specimen validity testing notice of proposed rulemaking. As I indicated in previous sessions, we are responsible by law to undergo our own rulemaking process. Much like Bob indicated with HHS, our particular urine SVT rule is in circulation. I cannot talk about it, but we are obviously hoping that it

goes through a quick circulation process and we can get it out.

However, a lot of our senior people who would be doing these reviews throughout the department and through the DOT agencies are pretty caught up with hurricane damage, and how quickly our particular NPRM circulates will be predicated on the responsibilities of both the secretary's office and also the various agencies in the hurricane process. We are hoping as quickly as possible. Without the hurricane, I think we would have had a fairly quick turnaround, but I have no way of predicting how quickly we will get it out in the interim.

However, I'm certainly encouraging everyone here to continue to use our Web site, which gives you immediate access to what is happening with us and our regulations. It not only gives you access to 49 CRF Part 40, our rules, but also each of the agency rules. It also gives you direct access or link access to all of the DOT agencies and the individuals who are responsible for the programs in the agencies.

In addition to that, we also maintain a link to our friends and colleagues at the Coast Guard, once belonging to the Department of Transportation, now belonging to the Department of Homeland Security. They continue to use, at least in great part, our 49 CFR Part 40 as part of their own testing of merchant mariners, and we continue to link with them as well.

Not only our Web site is important in terms of news and access to our regulations, but more importantly, especially in these times, you can continue to sign up for automated email notification. Every time we release anything, including this NPRM or we have news for you, you will automatically be notified.

For those of you that are already signed up, you will know that we try to, as often as possible, send out what we call our ODAPC dispatches, which kind of are news and issues of interpretation; also fixes that you can make in terms of problems that you may face as a service provider. Our Web access is: www.dot.gov/ost/dapc/. That gets you to our home page, and then you will see a button to click on to sign-up for the automated notification.

That is all I have right now other than once more to say all of our best wishes are to our friends at Kroll Laboratories, and all the collection sites that support us, as well as other third party administrators, et cetera, who are in the affected area. We have not heard from a lot of them, and we are doing the best we can to provide information on what service agents and employers can do with missing test results and missing records, et cetera.

Agenda Item: Nuclear Regulatory Commission Update

MR. MC CUNE (NRC): As my DOT and HHS friends have always mentioned, our hearts and thoughts go out to those impacted by Hurricane Katrina. We luckily, did not have any nuclear facilities impacted as a result of the hurricane. But we are monitoring the situation, and we do have some clean-up work at some of the nearby reactor sites.

Our responsibility at the NRC is to implement a program based on the HHS guidelines that ensures the safe operation of nuclear facilities. While we have a responsibility somewhat different than HHS, we certainly appreciate the opportunity to participate in the DTAB, because as we all know, the HHS is responsible for the base guidelines and policies, the technical basis if you will, for which nearly other Fitness for

Duty-like program in the federal government is based.

Since last we met, our policy, 10 CRF Part 26, Fitness for Duty Programs, has been announced in the Federal Register on August 26 for 120-day comment period which will close the 27th of December. All indications again are that the drug and alcohol portions of the rule, which also include fatigue provisions, are relatively non-controversial. We do have some issues that are not germane to the body given the push back by some stakeholders in the area of fatigue.

One of the other major impetuses that we have had since we last met, we have a requirement in the NRC to have our licensee report fitness for duty performance data, positive drug and cutoff levels every 6 months. We got caught up in June of this year. On the NRC Web site, we now have posted the FFD performance data through fiscal years 2003, and we hope to be posting the information and testing rates for 2004 relatively shortly.

In that regard, we really have not done, an adequate job of maximizing the information that we are getting in from a trending perspective, nor are we convinced that we have requested all of the information that will help us monitor the Fitness for Duty Program, as well as monitor the compliance and health of the program from a licensee perspective.

We have formed a working group that I chair to take a look at what information is absolutely required to measure the health of the program and compliance by the licensees, additional information like positive testing rates for information, or for drugs and analytes that are not specifically in the HHS panel.

We have a training program for behavioral observation. We have not previously tracked positive rates associated with the testing of the employees after undergoing a training program. We think that is of some benefit. We are looking at information of that type that can help us more accurately predict the health of the program again and compliance by the licensees.

We are also looking at expanding the program during the policy period for open comments by holding public meetings at the regions. We are having a public meeting the 21st of this month. The meeting notice is on the NRC Web site at www.nrc.gov. We invite all of you, if you are available, to participate in that meeting on the 21st. It will be in Rockville, Maryland at the Marriott.

Agenda Item: Public Comments

DR. MOORE (Immunalysis Corporation): My name is Christine Moore. I have three comments that I would like to share with the Board today.

The first is on the volume of oral fluid collected. In accordance with some comments from June 2005, we agree that a device for the collection of oral fluid is necessary. In order to provide accurate quantitation, however, you need to know how much you collect. Any device that is approved under this program needs to have basically an indicator of how much oral fluid you have collected.

This is should also be the total sufficient volume to perform the screen tests, and up to five confirmation tests, because who knows, you might get five screen positives. I doubt it, but you need the volume.

And observe collection of human oral fluid, as would be expected under

this program, I do not think should require the inclusion of an IgG test, because that just shows you a sufficiency of human antibody for HIV test. It does not have anything to do with drug testing or the volume collected.

A second point, which goes along with what Dr. Mitchell was speaking about is the stability of THC in oral fluid during collection, transport and storage. And the diluent or the buffer into which the pad is placed really does need to be characterized. And that is essential that the buffer is able to release the THC from the collection pad.

I am just going to summarize this data, because I would be here all day if I showed it all to you. This is from the Quantisal collector. Extraction of THC from the pad is consistently about 80 percent. At room temperature, you lose about 20 percent after 14 days. At refrigerated temperature, the loss is minimized but you still lose about 10 percent. Under fluorescent lighting, you lose about 50 percent of THC. You leave your samples on the bench, you are going to lose about 50 percent of the THC. If you store the specimen with the serum separator, which you push down onto the pad to squish out the oral fluid, you lose about 60 percent. As John says, THC sticks to everything.

We then did some transportation, and we shipped some samples to the East Coast and back again with some temperature indicators. At 62 degree F, you lose 21 percent of THC over two days, overnight transportation, 24 percent at 74 degrees F, and 36 percent at 79 degree F. If you are going to split samples or send to a separate lab for reconfirmation, I think you have to ship them on ice and overnight for sure, because even the ones on ice, the temperatures went up quite a bit.

And I am happy to share the whole data that goes with it, if you are interested in that at all, on how I got those numbers.

The third point is about opiate hair tests, and the proposed criteria for a positive result for opiate hair. The proposed guidelines right now require morphine to be present, as well as 6-acetylmorphine in hair in order to be positive. And during some studies that we had carried out, this rule will cause about 15 percent of heroin users to go undetected, because 6-acetylmorphine is the major metabolite in hair, and not morphine, with a median value of about 800 picograms per milligram; morphine was about 400.

In our self-reported heroin users, 7 out of 52, 15.5 percent, had substantial amounts of 6-acetylmorphine in their hair, well over the 200, but no morphine, or at least less than 200 morphine. If the focus of the program is to detect heroin users, then the presence of 6-acetylmorphine on its own should be a positive result. I think you should take away the requirement for morphine as well.

MR. STEPHENSON: The information that is received is not received as a part of a public comment period for regulatory consideration. However, Christine, I would appreciate your submitting the data that you are willing to share to Dr. Mitchell and Dr. Baylor. It might have some impact on how they address issues around PT manufacturing, shipping, and follow-up from that perspective.

At this time, in the absence of any other comments, I am going to close this session of the Drug Testing Advisory Board.

Open session was adjourned at 9:40 am

Attached:

First Presentation: Review: NLCP Pilot PT Program for Oral Fluids

Second Presentation: Pilot PT Program for Hair Cycle 8

Review: NLCP Pilot PT Program for Oral Fluids

Drug Testing Advisory Meeting
September 7, 2005

Items to be Covered

HHS Initiatives in Oral Fluid Drug Testing

NLCP Pilot PT Programs

Lessons Learned

HHS Initiatives in Oral Fluid

Public Meeting of SAMHSA Drug Testing Advisory Board

- **April 1997**

Industry Working Groups

- **May 1999**

Pilot PT Programs for Hair, Oral Fluids and Sweat

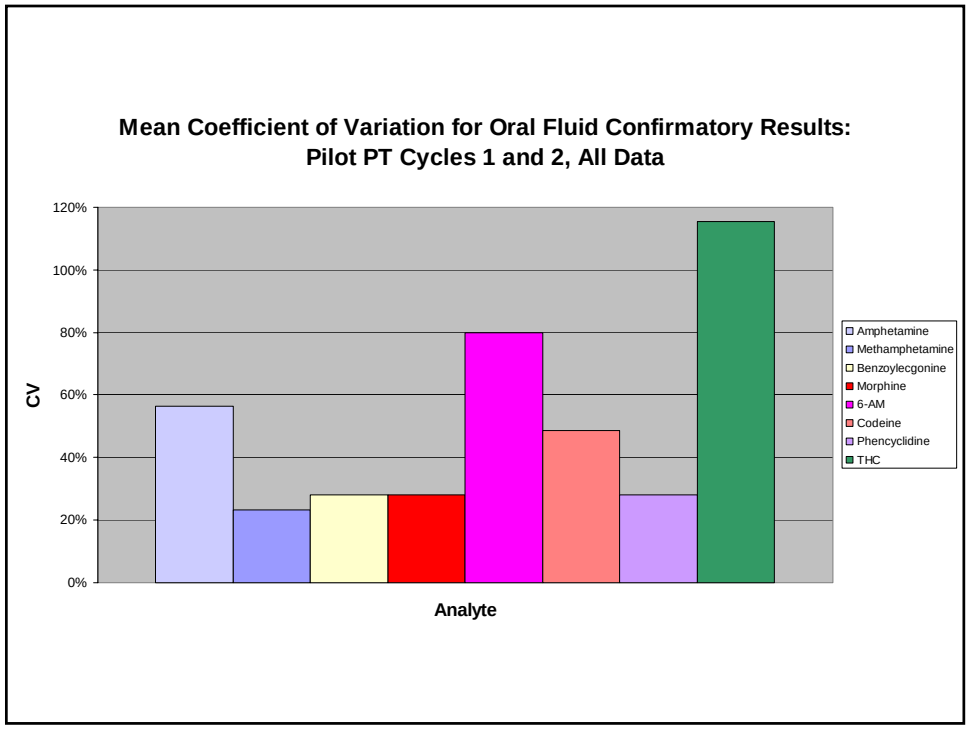
- **April 2000**

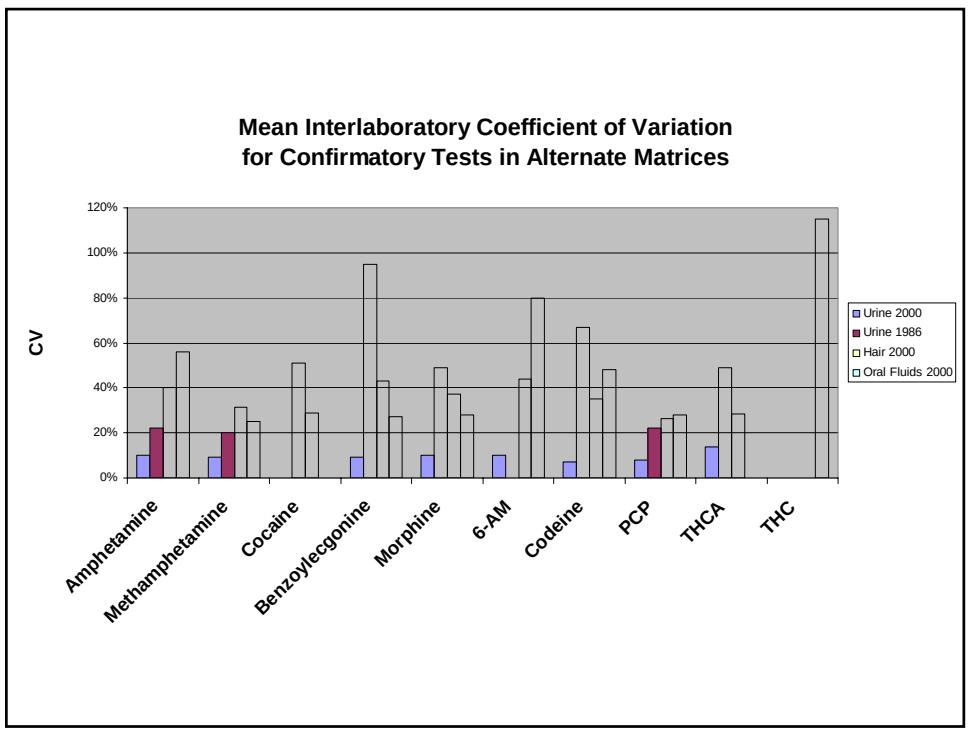
Proposed Revision to Mandatory Guidelines for Federal Workplace Drug Testing Programs, Federal Register Vol. 69, No. 71 pages 19673-19732

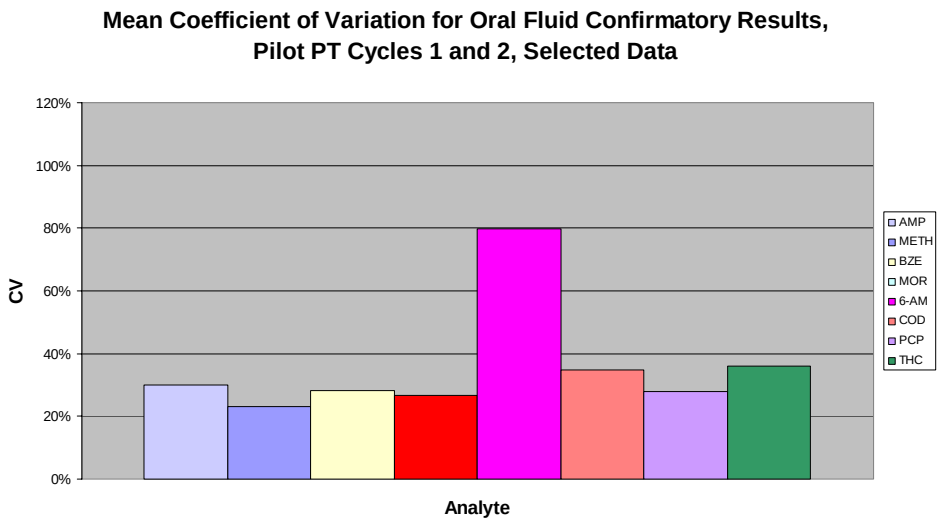
- **April 13, 2004**

Pilot PT Program for Oral Fluids: Phase I- Confirmatory Tests Only

- **Cycle 1 April 2000- 7 Laboratories**
- **Cycle 2 July 2000 – 7 Laboratories**
- **Cycle 3 March 2001- 6 Laboratories**
- **Purpose: To assess the ability of Oral Fluid laboratories to meet the cutoffs proposed by the industry working group and the issues involved in providing performance testing samples to monitor the quality of work.**
- **Issues identified**
  - **Testing variability**
  - **Analyte stability**
  - **Absorbent pad effects**


Mean Coefficient of Variation for Oral Fluid Confirmatory Results:
Pilot PT Cycles 1 and 2, All Data
120%
100%
80%
60%
40%
20%
0%
CV
Analyte
Amphetamine
Methamphetamine
Benzoylecgonine
Morphine
6-AM
Codeine
Phencyclidine
THC


Mean Interlaboratory Coefficient of Variation
for Confirmatory Tests in Alternate Matrices
120%
100%
80%
60%
40%
20%
0%
CV
Urine 2000
Urine 1986
Hair 2000
Oral Fluids 2000
Amphetamine
Methamphetamine
Cocaine
Benzoylecgonine
Morphine
6-AM
Codeine
PCP
THCA
THC



Phase 1, Cycle 3

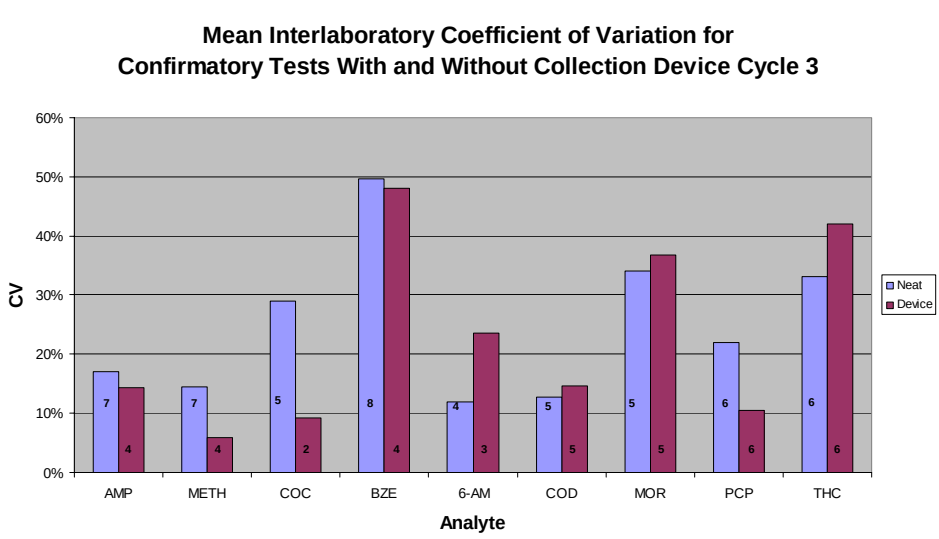
Samples similar to those in Cycle 1 and 2.

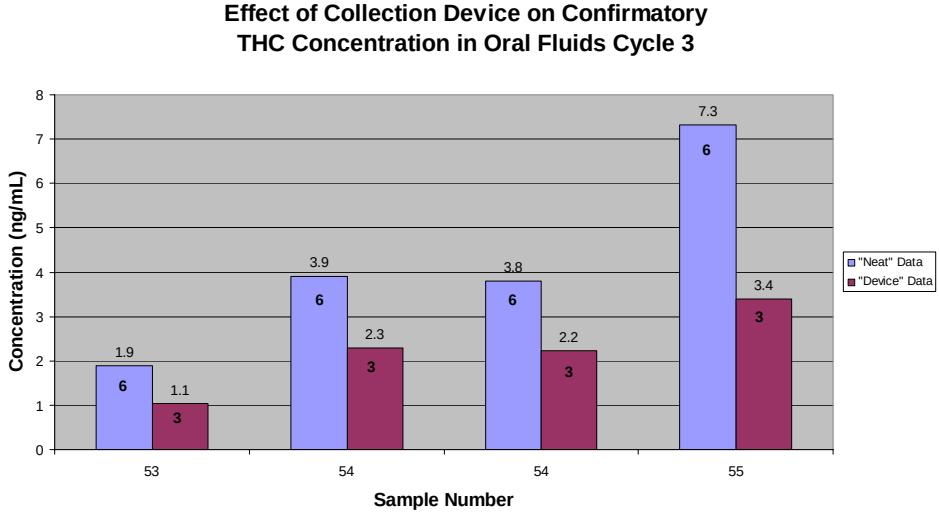
- **Analyte concentrations 0.5 – 3x proposed cutoffs**

Laboratories utilizing absorbent collection devices asked to analyze each sample twice.

- **Neat, and**
- **Spiked onto collection device**

5


Mean Interlaboratory Coefficient of Variation for
Confirmatory Tests With and Without Collection Device Cycle 3
60%
50%
40%
30%
20%
10%
0%
CV
7
4
7
4
5
2
8
4
4
3
5
5
5
5
6
6
6
6
AMP
METH
COC
BZE
6-AM
COD
MOR
PCP
THC
Analyte
Neat
Device


Effect of Collection Device on Confirmatory
THC Concentration in Oral Fluids Cycle 3
8
7
6
5
4
3
2
1
0
Concentration (ng/mL)
1.9
6
1.1
3
3.9
6
2.3
3
3.8
6
2.2
3
7.3
6
3.4
3
53
54
54
55
Sample Number
"Neat" Data
"Device" Data

Pilot PT Program Phase II: Confirmatory Tests Only

- **Cycle 4 October 2003 - 13 Laboratories**
- **Cycle 5 December 2003- 12 Laboratories**
- **Cycle 6 January 2004 - 12 Laboratories**
- **Purpose: To assess the inter- and intra-laboratory variability of Oral Fluid laboratories by presenting same samples over three PT cycles.**
- **Issues identified**
  - **Testing variability**
  - **Analyte stability**

Study Design

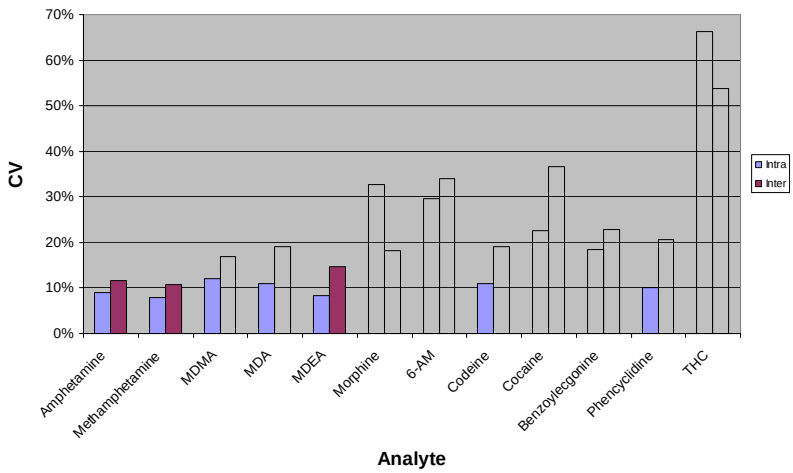
Oral Fluid PT Cycles 4, 5 and 6

Human Oral Fluid spiked with analytes at 0.5, 1 and 2-3 times the HHS proposed Cutoff

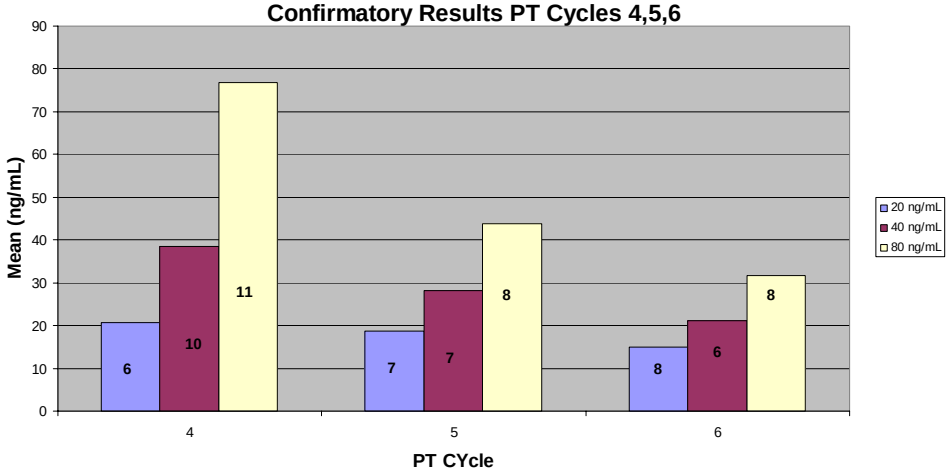
Complete set of samples including all analytes and concentrations sent to laboratories 3 times over a 3 month period for analysis without collection devices.

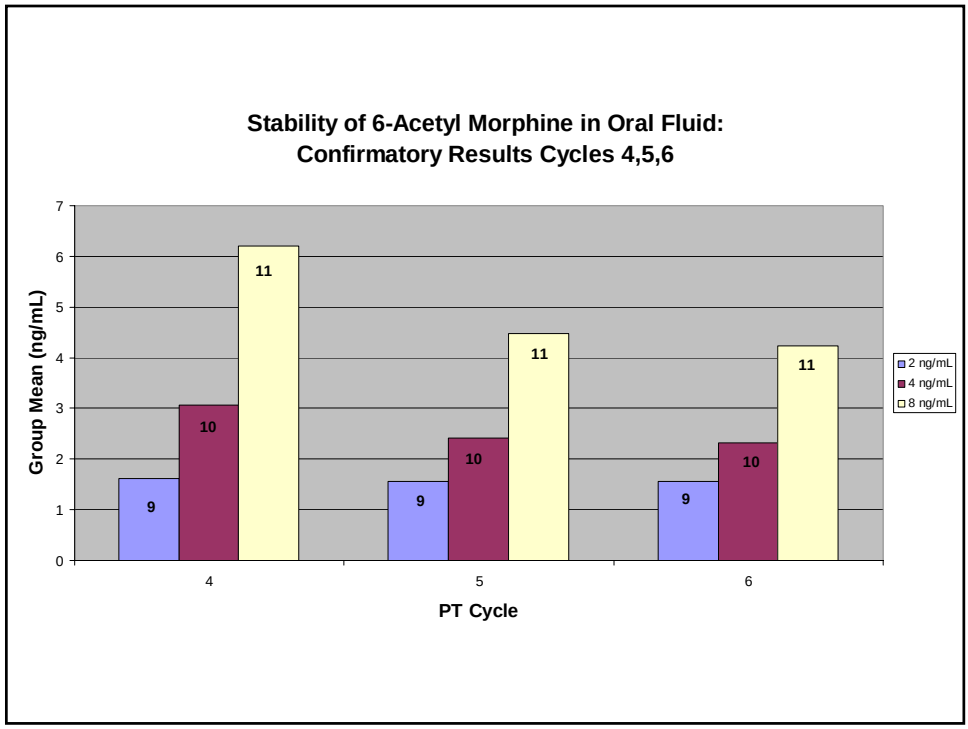
Laboratories received no feedback on performance until after receipt and analysis of all data from all cycles

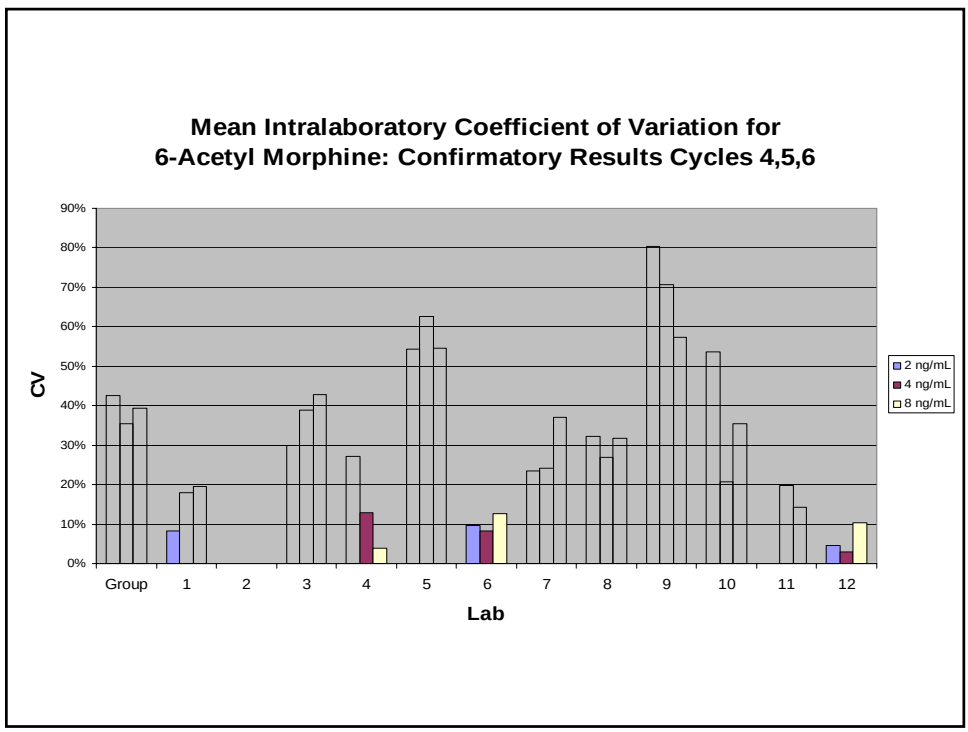
Mean Intra- and Inter-laboratory Coefficients of Variation for Confirmatory Testing in Oral Fluids PT Cycles 4, 5 and 6

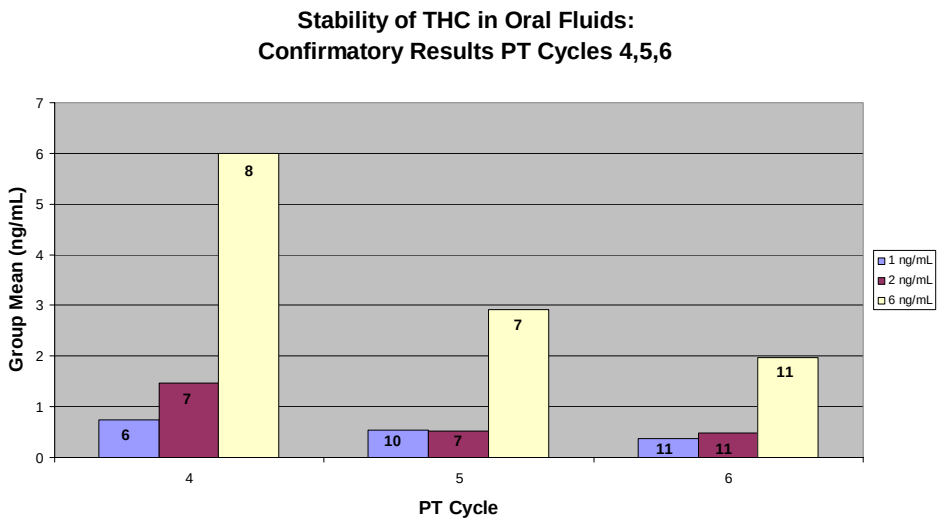


Stability of Morphine in Oral Fluid: Confirmatory Results PT Cycles 4,5,6



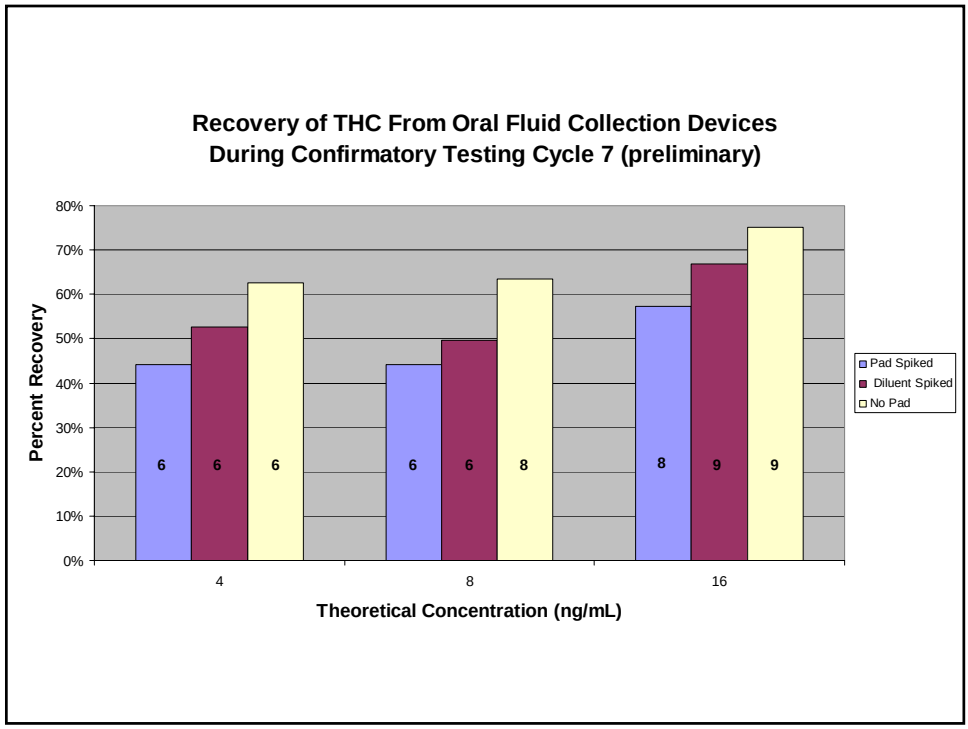

Stability of 6-Acetyl Morphine in Oral Fluid:
Confirmatory Results Cycles 4,5,6
Group Mean (ng/mL)
0
1
2
3
4
5
6
7
9
10
11
9
10
11
9
10
11
4
5
6
PT Cycle
2 ng/mL
4 ng/mL
8 ng/mL

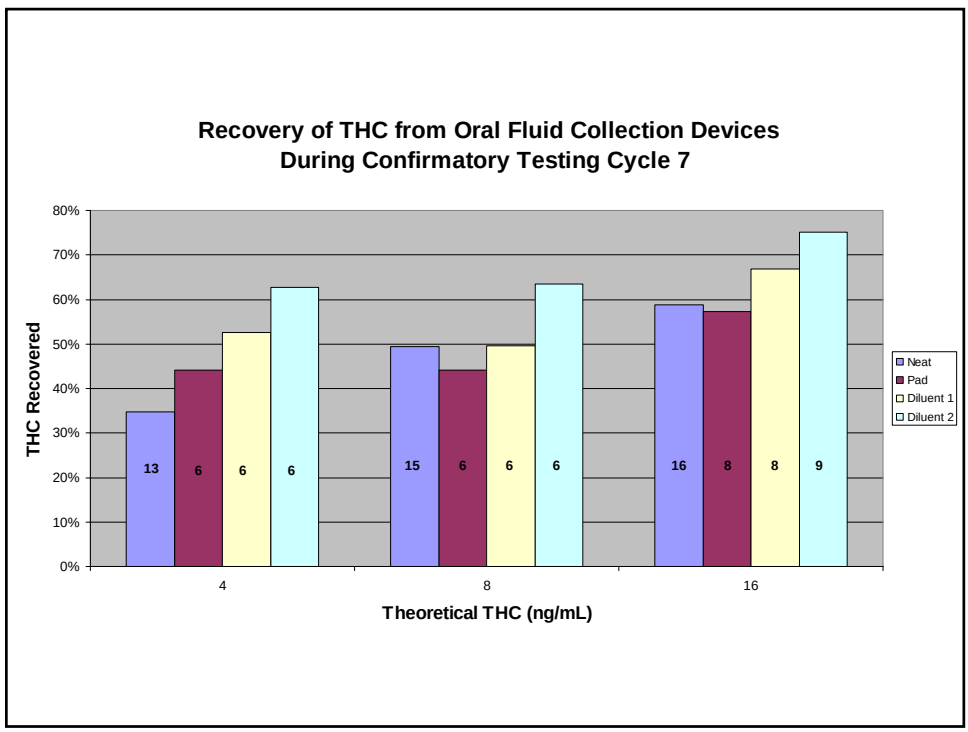

Mean Intralaboratory Coefficient of Variation for
6-Acetyl Morphine: Confirmatory Results Cycles 4,5,6
CV
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
Group
1
2
3
4
5
6
7
8
9
10
11
12
Lab
2 ng/mL
4 ng/mL
8 ng/mL

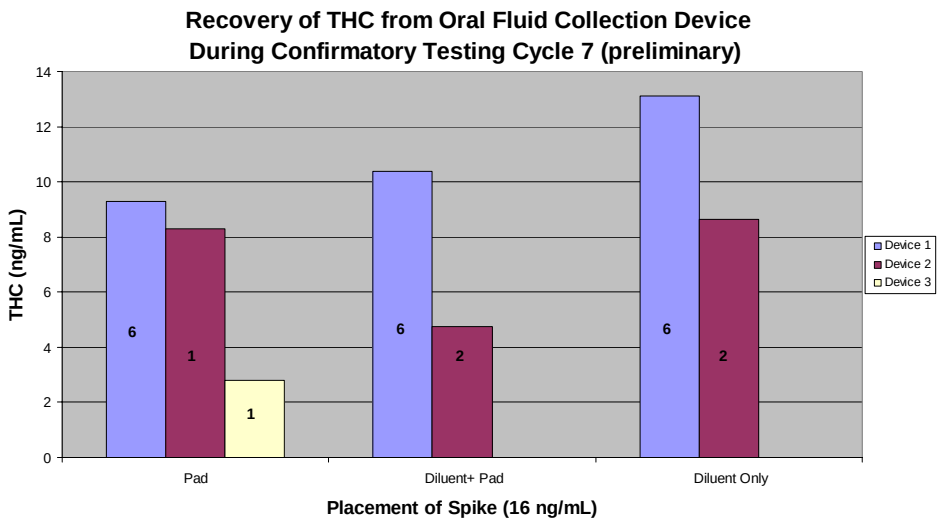


Pilot PT Program Phase III

- **Cycle 7 December 2004 - 16 laboratories**
- **Cycle 8**
- **Cycle 9**
- **Purpose: In addition to Phase I objectives:**
  - **to assess confirmatory procedures for 9-carboxy THC in oral fluids (unpublished reports of THCA presence)**
  - **to further assess collection device variability and analyte stability for THC, THCA, morphine and 6-acetylmorphine.**
- **Issues identified**
  - **Work in Progress**


Recovery of THC From Oral Fluid Collection Devices
During Confirmatory Testing Cycle 7 (preliminary)
Percent Recovery
80%
70%
60%
50%
40%
30%
20%
10%
0%
6
6
6
6
6
8
8
9
9
4
8
16
Theoretical Concentration (ng/mL)
Pad Spiked
Diluent Spiked
No Pad


Recovery of THC from Oral Fluid Collection Devices
During Confirmatory Testing Cycle 7
THC Recovered
80%
70%
60%
50%
40%
30%
20%
10%
0%
13
6
6
6
15
6
6
6
16
8
8
9
4
8
16
Theoretical THC (ng/mL)
Neat
Pad
Diluent 1
Diluent 2



Lessons Learned

Human Oral Fluid collected by spitting is difficult to use as a QA/QC material

- **Difficult to collect large volumes**
- **Subject to bacterial contamination**
- **Extremely hard to filter or pipette**
- **Freeze thaw cycles help with handling and changes the viscosity**
- **Cannot be easily filter sterilized**

Dilution of oral fluids with diluents utilized by many of the device manufacturers increases stability and ease of production of QA/QC products

Lessons (cont)

Some drug analytes require special precautions:

- **Morphine and 6- AM – need to stabilize with antioxidant such as sodium bisulfite**
- **THC – stability increased by addition of BSA to solutions**
- **Cocaine – will hydrolyze to benzoylecgonine and ecgonine methyl ester and ecgonine at neutral and higher pHs**

All solutions of drug analytes in human oral fluid should be stored at -20^{o}C

Samples should be analyzed soon after thawing

External QA/QC samples are essential to establishing and maintaining laboratory quantitative performance.

Pilot PT Program for Hair Cycle 8

Status Update
DTAB
September 7, 2005

Acknowledgements

Division of Workplace Programs, Center for Substance Abuse Prevention, Substance Abuse and Mental Health Administration for financial support of this effort through the National Laboratory Certification Program contract (277-2003-00044).

All the NLCP staff who have contributed to the success of this effort, especially Meredith Meaders and Andy McDaniel.

Cycle 8 of Pilot Hair PT Program Objectives

To determine inter- and intra-laboratory performance

To evaluate analyte stability in hair incorporated >1 year from BPR

To evaluate laboratory efforts to improve performance

To evaluate laboratory performance on liquid spiking solutions over 2 cycles (1 yr interim)

Participating Laboratories

9 Labs Participated

- **5 continuous participation**
- **2 returning participation**
- **2 new laboratories**

Submittal of Initial & Confirmatory Tests Matrices to RTI (Jan 2005)

Samples shipped last week in January

Cycle 8 of Pilot Hair PT Program: Confirmation Analysis

Lab	Specimen Required per Drug Class Tested (mg)	Pretreatment Wash	Pretreatment Powdering of Hair	Pretreatment Digestion of Hair
E	50	Y	Y	N
G	10	Y	N	Y
H	20	Y	N	Y
I	50	Y	Y	N
L	20	N	Y	THCA: Y Others: N
N	THCA: 20 Others: 10	Y	N	N
O	20	Y	N	Y
P	20	Y	N	THCA: Y Others: N
Q	20	Y	N	Y

Cycle 8 of Pilot Hair PT Program: Confirmation Analysis

ANALYTE	Number of Labs Testing for Analyte and LOQ Meets HHS Proposed Cutoffs	Number of Labs Testing for Analyte and LOQ does not Meet HHS Proposed Cutoffs	Number of Labs Not Testing for Analyte
AMP, MAMP, MDA,MDMA, COC, BE, MOR, 6-AM, COD, PCP	10	---	---
CE	9	---	1
THCA	6	1 lab: LOQ 0.3 pg/mg 1 lab: LOQ 1.0 pg/mg	2
MDEA	6	1 lab: LOQ 400 pg/mg	3
NCOC	4	---	6

Pilot PT of Hair: Cycle 8

Selected Specimens from Cycles 5-7

Included in Shipment:

- **12 NLCP spiked hair strands**
- **4 liquid spiking solutions (50 & 100 µL)**

Last of Laboratory results received March 4, 2005

Pilot PT of Hair: Cycle 8

Concentrations: 50% below Cutoff to 300% above Cutoff

Confirmatory Testing Only

Analytes included:

- **Amphetamines (AMP, MAMP, MDMA, MDEA, MDA)**
- **Cocaine and Metabolites (BE, CE, NOR)**
- **Opiates (COD, MOR, 6-AM)**
- **THC Acid**
- **Phencyclidine**

Cycle 8: Hair PT Results

All Labs did not submit results within 10 working days as requested

Final Reports to Labs included:

- **Reference or Target Concentration (pg/mg)**
- **Result Reported by Specific Lab**
- **Mean Concentration of All Participating Labs***

Cycle 8: Hair PT Results

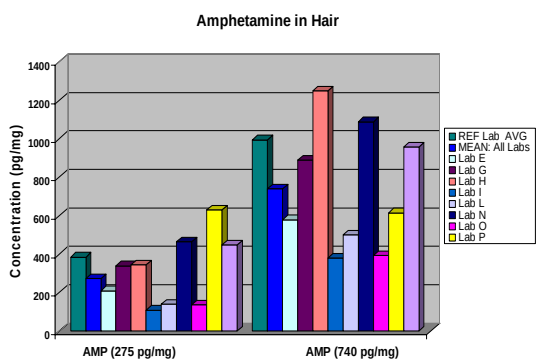
Specimens and Mean Values:

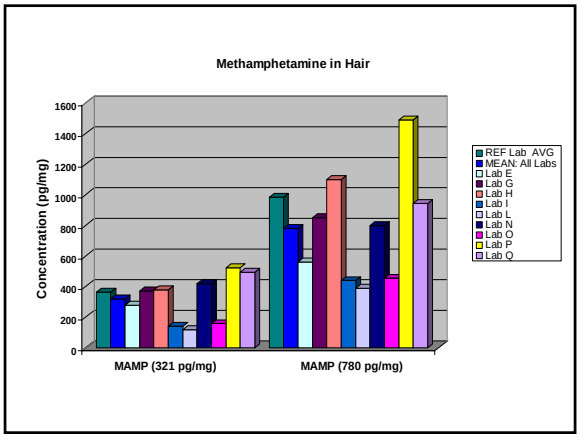
- **Amphetamines**
  - **AMP: 275 & 740 pg/mg**
  - **MAMP: 321 & 780 pg/mg**
  - **MDMA: 311 & 517 pg/mg**
  - **MDEA: 193 & 452 pg/mg**
  - **MDA: 309 & 515 pg/mg**
- **THC Acid**
  - **0.051 & 0.085 pg/mg**
- **Phencyclidine**
  - **359 pg/mg**

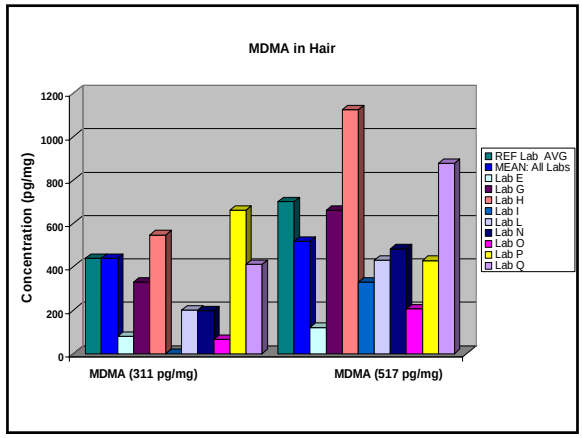
Cycle 8: Hair PT Results

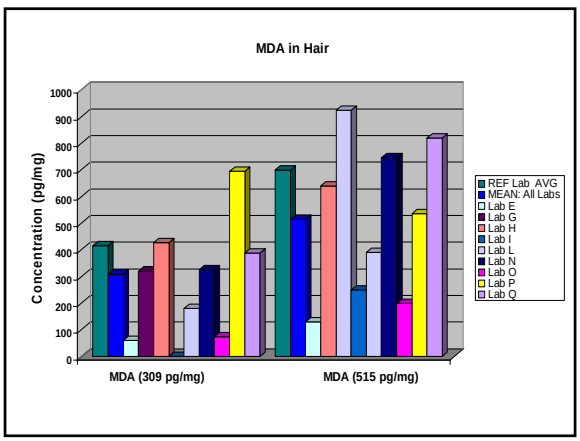
Specimens and Mean Values:

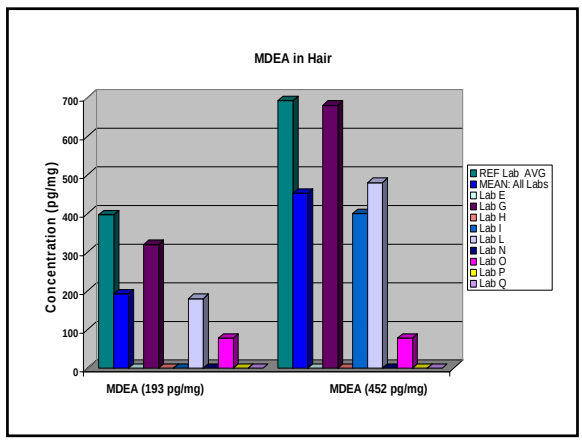
- **Cocaine and Metabolites**
  - **COC: 856 & 1045 pg/mg**
  - **BE: 92 pg/mg**
  - **CE: 120 & 126 pg/mg**
  - **NOR: 259 & 287 pg/mg**
- **Opiates**
  - **COD: 190 & 319 pg/mg**
  - **MOR: 261 & 404 pg/mg**
  - **6-AM: 162 & 274 pg/mg**

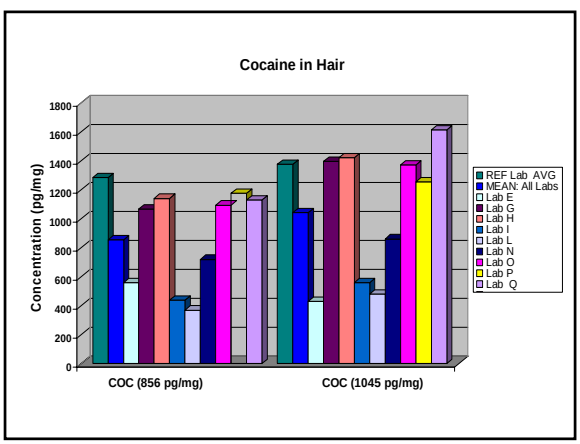


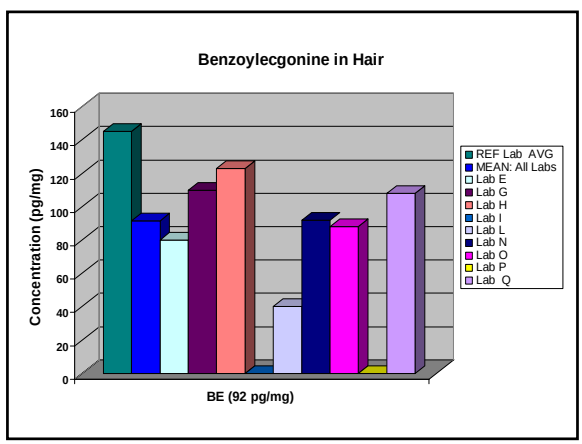

Methamphetamine in Hair
Concentration (pg/mg)
1600
1400
1200
1000
800
600
400
200
0
MAMP (321 pg/mg)
MAMP (780 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

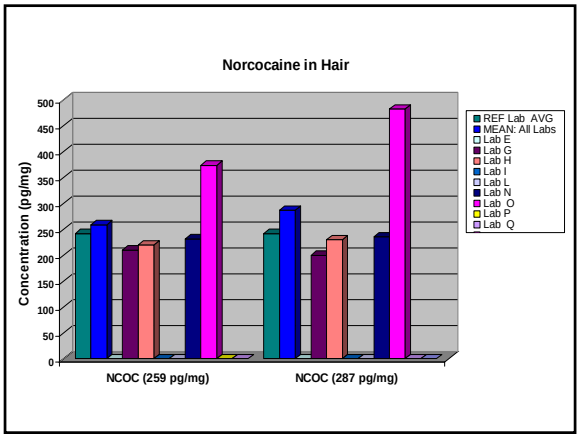

MDMA in Hair
Concentration (pg/mg)
1200
1000
800
600
400
200
0
MDMA (311 pg/mg)
MDMA (517 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

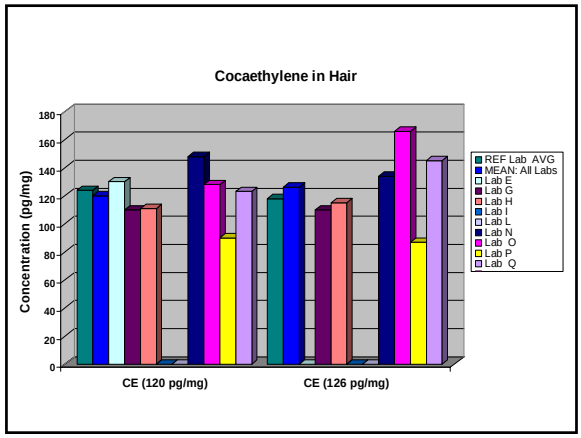

MDA in Hair
Concentration (pg/mg)
1000
900
800
700
600
500
400
300
200
100
0
MDA (309 pg/mg)
MDA (515 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

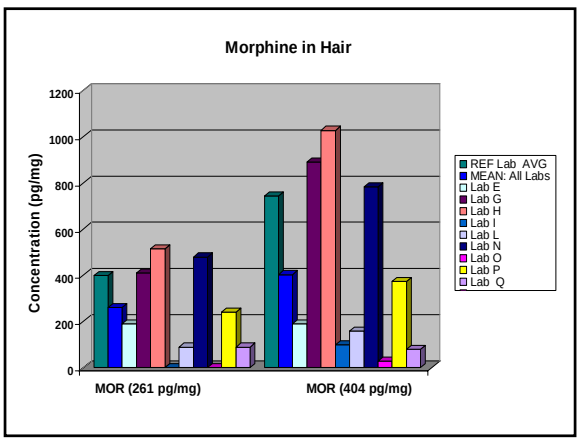

MDEA in Hair
Concentration (pg/mg)
700
600
500
400
300
200
100
0
MDEA (193 pg/mg)
MDEA (452 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

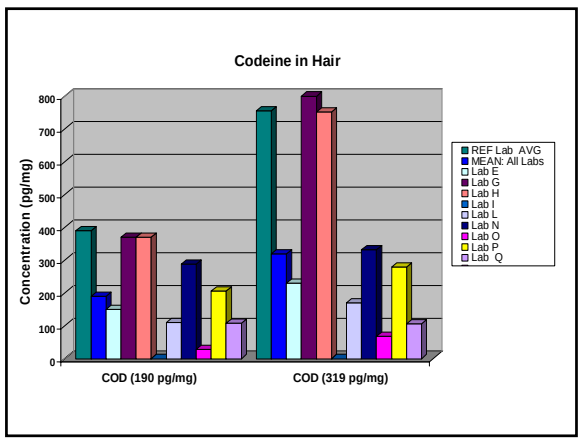

Cocaine in Hair
Concentration (pg/mg)
1800
1600
1400
1200
1000
800
600
400
200
0
COC (856 pg/mg)
COC (1045 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

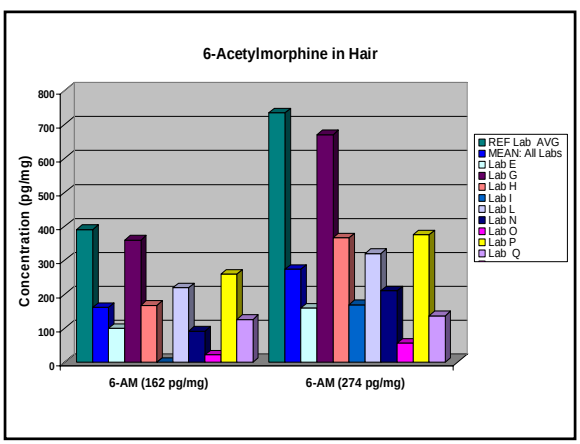

Benzoylecgonine in Hair
Concentration (pg/mg)
160
140
120
100
80
60
40
20
0
BE (92 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

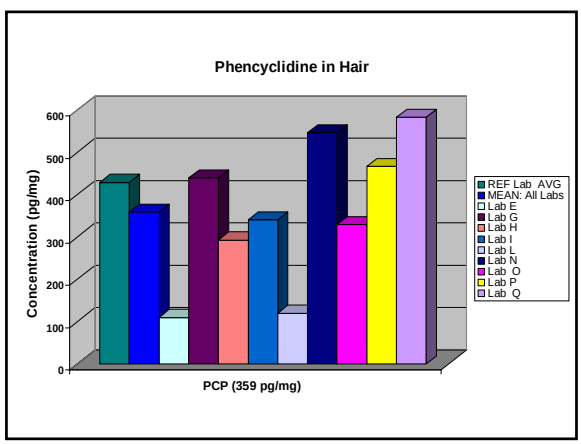

Norcocaine in Hair
Concentration (pg/mg)
0
50
100
150
200
250
300
350
400
450
500
NCOC (259 pg/mg)
NCOC (287 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

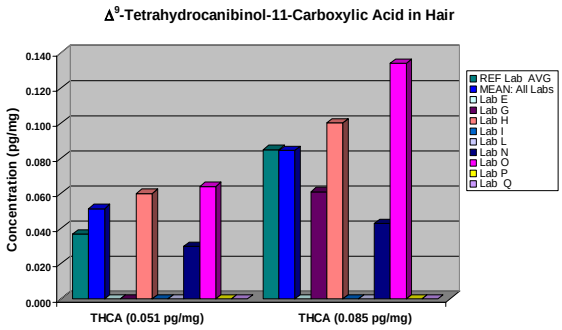

Cocaethylene in Hair
Concentration (pg/mg)
0
20
40
60
80
100
120
140
160
180
CE (120 pg/mg)
CE (126 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

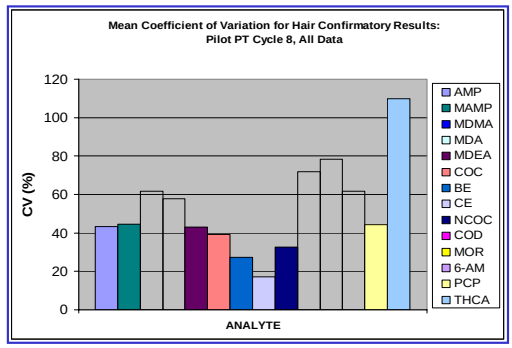

Morphine in Hair
Concentration (pg/mg)
0
200
400
600
800
1000
1200
MOR (261 pg/mg)
MOR (404 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q

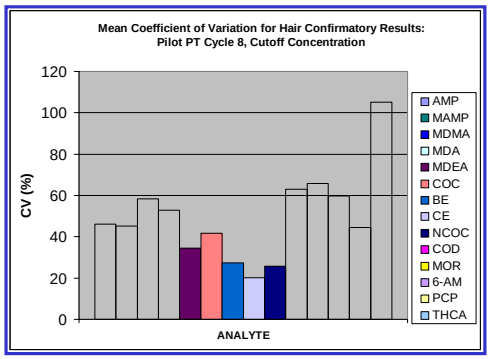

Codeine in Hair
Concentration (pg/mg)
0
100
200
300
400
500
600
700
800
COD (190 pg/mg)
COD (319 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q


6-Acetylmorphine in Hair
Concentration (pg/mg)
0
100
200
300
400
500
600
700
800
6-AM (162 pg/mg)
6-AM (274 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q


Phencyclidine in Hair
Concentration (pg/mg)
0
100
200
300
400
500
600
PCP (359 pg/mg)
REF Lab AVG
MEAN: All Labs
Lab E
Lab G
Lab H
Lab I
Lab L
Lab N
Lab O
Lab P
Lab Q







Broad Conclusions

Agreement with BPR Target highly variable

- **6 analytes within ±20 of Target**
- **Analytes with greatest discrepancy:**
  - **6-AM at 75% of Target**
  - **NCOC at 400% of Target (new analyte)**

Reported Concentrations: ±20 of Target

- **Amphetamines: 1-3 labs**
- **Cocaine and Metabolites: 1-5 labs**
- **Opiates: 1-2 labs**
- **THCA: 1 lab**
- **PCP: 3 labs**

Broad Conclusions

Overall Agreement among laboratories not evident (Mean CV: 17-78%)

Drugs having the most discrepancy among laboratories are Opiates and THCA

Predictive incorporation of drug into hair remains a challenge