
CONSTRUCTION PROJECTS COMMITTEE
THURSDAY, OCTOBER 23, 2008
NASHUA HIGH SCHOOL NORTH LECTURE HALL
7:00 PM

A meeting of the Construction Projects Committee was held at Nashua High North on **Thursday, October 23, 2008**. Alderman McCarthy called the meeting to order at **7:03 p.m.**

Present: Alderman McCarthy, Alderman Tabacsko, Mr. Dowd, Mr. Hollowell

Also Present: Mr. Smith, Alderman Teeboom, Mr. Haas, Mr. Mosher, Mr. Dubois, Mr. Caulfield, Mr. Harrison, Dr. Phetteplace

APPROVAL – CONTRACT WITH TURNER BUILDING SCIENCE AND DESIGN, LLC for the design and contract administration services for the replacement of HVAC systems at Fairgrounds Elementary and Ledge Street schools.

MR. HALLOWELL MOVED TO TABLE DISCUSSION OF THE CONTRACT UNTIL AFTER DR. PHETTEPLACE'S REPORT.

SO VOTED.

REPORT: DR. PHETTEPLACE'S PEER REVIEW REPORT of Turner's geothermal design for the replacement of the HVAC system at Fairgrounds Elementary school.

Mr. Smith

Dr. Phetteplace took a look at the design that Turner put together, and I think it's best if he talks to that.

Dr. Phetteplace

I have a lot of issues with the design. For starters it's very unconventional for a geothermal. Typically geothermal heat pump systems are designed as unitary equipment. So you have individual heat pumps out in the zones rather than say in a mechanical room. That's just the way it works the best and saves energy. The Turner system is trying to combine geothermal with displacement ventilation. Displacement ventilation is very good, but it doesn't really marry up well with geothermal. They can work together, but it's not going to be an efficient way to get it done. I have never seen it done that way. That's the big issue. Then there are a lot of smaller issues.

There are a lot of issues with the details of the ground coupling. They want to use these 1,500 ft. deep wells with a concentric type heat exchanger. That is simply not done and not the industry standard. They also want to use PVP pipes, which is also never used in these systems. They want to use boilers inside the system to supplement the geothermal. It seems like they want to use that so they don't need antifreeze, which causes other issues. I would recommend using antifreeze. I don't think you will achieve the same savings by marrying these two systems.

Alderman McCarthy

My understanding was that the reason for the boilers was to avoid additional well length on the coldest days of the year and not so much to avoid the use of antifreeze.

Mr. Caulfield

That's correct. It's not necessarily to avoid the use of antifreeze.

Mr. Phetteplace

Either one will displace boilers... either more loop length or the use of antifreeze. You can have a combination of those 2, which is probably what would end up happening with a closed loop design. Without boilers you'd probably end up with more loop length. My suspicion is that there's not enough loop length the way it is now, although I wasn't given the load calculations.

Turner Representative

A boiler can be added to reduce the loop length in a closed system. In an open system it becomes irrelevant because you can just pump the water and get all the heat you want. It's much less expensive to install a boiler.

Mr. Phetteplace

But it brings with it the potential control problems. I've seen those problems, and I see very installations go in with boilers. Because the liability of having those boilers and the control issues that go with it, does not offset the extra loop cost.

Turner Representative

But that's a fundamental difference between a closed and open loop. In an open loop it just makes no sense to put a boiler in because it's not cost effective. But when you make the decision to go to a closed loop you have to change your thinking and do what makes economic sense... and it's not putting in more length of well because the cost of payback just isn't there.

Mr. Phetteplace

I agree with you. I have been talking closed loop all along. Most people when they make that decision do not put in boilers.

Mr. Dowd

There is not enough air movement in the schools to generate acceptable levels of learning. And all the new schools have much higher requirements of HVAC to move air. So which system generates more air flow and less carbon dioxide in the school?

Alderman McCarthy

My understanding from previous displacement projects that we've done is that the major advantage of displacement is the stratification of air as its ventilated in the classroom which results in significantly lower levels of CO2 and lower levels at the layer at which people are breathing in the classroom, which is one of the reasons why I certainly have pushed for displacement.

Mr. Harrison

I think you hit it right on the head.

Mr. Phetteplace

You can get acceptable air quality without doing that. You can use CO2 monitoring and if it goes too high, you start bringing in outside air. That works in other situations.

Mr. Dowd

I believe the schools that we're talking about don't have acceptable levels based on the new standards. And if additional airflow into the school is going to help the educational process, I wouldn't be concerned about a slightly higher cost because we have more to be considering than the ambient temperature of the rooms.

Mr. Harrison

One of the fundamental differences between the displacement ventilation and mixing systems is the ability to deliver fresh air to the classroom with less fan horsepower.

Mr. Dowd

Classrooms are smaller than state standards right now, so anything taking up room in our classrooms is not in our best interest. And I'm curious where would the distributor unit, which appears to be quite large, be mounted?

Dr. Phetteplace

I was told that some of the glass would be taken out, so that would logically be where you'd put it. But you can do it any number of ways. It doesn't have to be done this way. As far as the whole mixing vs. displacement ventilation, when you look at non central systems, there won't be any fan power advantage. That's when you compare it to other central systems, which we're not using.

The displacement system cannot provide heat by itself. If it did, it would turn into a mixing system. So whatever you bring in through that displacement system is going to be cooler than that room. So even in the winter, you're bringing in cool air.

Mr. Harrison

Dr. Phetteplace is correct. The displacement system is not intended to provide heat to the space. We can put it into warm up mode in the early morning, but once the students get there we try to deliver the air about 2 degrees cooler than the room temperature. So the thin tube takes care of the window losses during the day time, which is relatively small.

Mr. Caulfield

One of the benefits of the displacement is that it comes in at a relatively neutral temperature and then is allowed to get to where people are.

Dr. Phetteplace

Displacement may be better, but it's not the only way to do it.

Mr. Hallowell

After reading Dr. Phetteplace's review I come back to the same conclusion I had before. I don't think Dr. Phetteplace is saying that you can't build a system this way. I think his expertise is telling us that no one else has done it this way and no one else has used these components in this way. So my concern is what risks are you buying into 10 years from now when Turner and Harvey are no longer around and we're struggling with how to make the system operate correctly?

Alderman McCarthy

The good news is that I suspect the risk is on day one and not 10 years down the road.

Mr. Hallowell

Well, that's not what I heard Dr. Phetteplace say. There are risks to leaks inside the concentric tubing. That's not something that's going to happen on day one.

Alderman McCarthy

I agree that there are things about the geothermal system itself.

Mr. Hallowell

I don't think I hear Dr. Phetteplace saying that you can't make displacement work in combination with geothermal. He just doesn't feel that it's an efficient solution. And it sounds like he's saying that the extra cost of doing the displacement air doesn't make sense because you lose efficiency doing it that way. And we won't know that until years down the road. And we won't really have a baseline to measure it against because there won't be another system that does it this way.

Alderman McCarthy

I agree with you that it's a question of what is the displacement worth to us and is it worth the changes in efficiencies that we may get by marrying it to geothermal. My personal opinion is that hot water is hot water and whether we get it from geothermal or boilers, the other side where the displacement system is will work. The question is whether or not it will have the same efficiency and whether we'll realize the savings that we hope to realize on the operation system that pays for it.

Dr. Phetteplace

Hot water is not hot water. Hot water from a boiler at 180 degrees heats a lot better than hot water from a heat pump that heats at say 120 degrees tops. It's a huge difference. Baseboard is typically not used for those kinds of temperatures because it does not have the output.

Mr. Harrison

We do account for that. A lot of the talk going on about geothermal is putting the penalty on the displacement system to carry the cost of the geothermal, when they're really separate issues. We can unitary equipment in the classroom as has been suggested, but the noise criteria standards would not be met. We could put the unitary systems out in the hallway, or ceiling space, etc. as is done in other schools.

Dr. Phetteplace

I wouldn't be able to say that there is no heat pump equipment that will meet NH standards. I don't know if that's the way it's normally done. If it is, then we're all being measured by the 24 hour standard.

Alderman McCarthy

If the 24 hour average is being used to meet what is effectively intended to be an instantaneous standard from the state that is not particularly helpful. If the standard says that noise level in the classroom should be less than 65 db and when the kids are there it's 85 but the rest of the time it's really quiet, we're not meeting the standard. That is not in the interest of the kids who are in there. We're going to need to resolve that issue with any system if we're adhering to the intent and not the letter of the standard, I suspect.

Mr. Hallowell

What is the standard and the peak of decibel for the standard?

Mr. Harrison

The standard is 35 the peak is either 45 or 48.

Mr. Hallowell

And what's the peak noise for the distributed system?

Mr. Harrison

It's probably not something that you can measure.

Mr. Dowd

Which system has more hardware that can fail?

Mr. Harrison

The distributed system because each classroom has its own piece.

Mr. Dowd

Typically no matter how reliable a system is, the more hardware you add into the equation, the lower the reliability of the system. 90% of the classrooms may not have an issue at all, but 10% might. If maintenance is higher than the other system, that adds to the cost. I've talked to the custodians about changing filters and they feel they're already changing more than they need or want to.

Mr. Hallowell

Well that's a contract issue. I thought I just heard Dr. Phetteplace say that these systems are potentially more reliable than having one or a few big ones. So if you're afraid of having one or two systems going down, the nice thing about having a distributed system is you can up the output of various ones to at least keep the room cool or hot, which you wouldn't be able to do if the whole system was down. So there are advantages to distributed systems. From everything I've read, these systems are very reliable.

Mr. Harrison

Generally they'll fail within the first 3 years under the warranty period if they're going to fail. If they don't fail then, they'll generally last about 20 years. So at that 20 year mark you have extensive replacement cost and down time of closing a classroom for each one.

Dr. Phetteplace

Under the proposed design, you're going to have a lot of heat pumps around. So are going to be much more difficult to get out that something like this. And there is a spare for the classroom units.

Mr. Hallowell

I thought I heard Turner say that one of the reasons for the 1,500 ft. wells was that it reduced our footprint. I know that Fairgrounds has a pretty small footprint. Is that a valid reason to have the deeper wells? If it's all about length, why not go deeper if you can?

Dr. Phetteplace

Because it's more expensive for starters. You've only got 7 wells on there. It wouldn't be any problem to get more wells on that property. I can't say for sure that there's enough on the site, though.

Mr. Harrison

If we added antifreeze to it we could get more heat capacity out of the well. But it's something we choose not to do to avoid the risk of having something leaking into the environment.

Dr. Phetteplace

That's why we have regulations that we grout these wells with impermeable grout. That's why it's done that way.

Alderman Tabacsko

Which decision is appropriately made first? The question about geothermal or the question about distributed vs. displacement?

Mr. Harrison

The displacement ventilation system first. Because that drives a lot of other choices after that.

Alderman Tabacsko

Assuming that displacement is decided, with the rest of the design that you've been able to review... is the rest of the design okay? I notice in your write up you were advocating the open loop rather than the closed loop. I don't fully understand that difference.

Dr. Phetteplace

There are a lot of other concerns I would still have. These wells are not the approach in which I would want to go. Either open or closed loop would work. If you have a site that can support the open loop, it will probably be less costly. So you should find that out first. As far as the decision matrix, the problem is that once you choose the displacement system vs. the distributor system you basically put a big liability on using geothermal because it doesn't really marry up very well with this displacement ventilation. It's made its reputation as efficient and cost effective by using unitary equipment distributed out in the zones.

Mr. Harrison

If you choose to go displacement ventilation, unitary equipment doesn't really apply to that and you'd go to the central system and the unitary option is off the table...

Mr. Hallowell

I think I hear you saying that if you're going to do displacement air, you might be better off putting in your oil or natural gas boiler to heat water so that the system works well.

Dr. Phetteplace

I think the bottom line is that you're not going to achieve the savings by going to geothermal that you would by going otherwise. I'm not saying that you might not still have a system that would operate at less cost than a fossil fuel system. I don't think you're going to get the return of the big investment you've put into a geothermal system, because you've taken the unitary approach out of it.

Mr. Harrison

But there is a net gain, given the cost of fossil fuels.

Dr. Phetteplace

It's probably going to operate at less cost, but it will be done at a big premium of first cost. So it's hard to say if it's going to be a life cycle savings. I don't think so, though.

Alderman McCarthy

From my perspective, that decision is based on our cost of ownership from day 1 to day end. We currently have a fairly high cost of ownership. The analysis from Turner shows that our yearly cost of ownership goes down even in year one even with the high first costs of the displacement geothermal system. I absolutely agree that if we go with the geothermal with unitary equipment that first cost is much lower, the payback period is much shorter, etc. But if we believe that the displacement system gets us improvements in air quality that are worth some investment... particularly if that investment is essentially free because we're still within the current operating budget for both the capital investment and the operating of the equipment, I think that's why some of us lean towards doing that. The analysis shows that over 20 years, starting at day 1 our capital cost plus operating cost to do that work is less than what our operating cost is otherwise. Have you seen that analysis and do you agree with it in terms of the costs that are presented in that life cycle cost?

Dr. Phetteplace

If it was in the stuff that was sent me and it very well may have been... I haven't looked at it. I don't recall seeing it... your cost analysis for payback.

Mr. Harrison

I don't know that it came in so many words. There were a number of graphs that showed payback of various pieces. But I don't know that we gave Dr. Phetteplace the same graph that you saw in this committee as far as life cycle costs.

Dr. Phetteplace

That's a pretty tough calculation to make.

Mr. Dowd

I've heard concerns about the huge difference in cost between one system vs. the other. Are we talking apples to apples or apples to oranges? We may not be taking into account some of the ancillary costs like ripping up the school and putting it back together again. That can be very significant. Are we that far apart from \$2 million to \$20 million that I'm hearing? I don't see how that can possibly be true. I don't think we're considering all the costs in one option.

Mr. DuBois

The primary difference between both systems when you're looking at an air distribution system you is not only distributing duct work throughout the school, but also piping. Trying to retrofit the schools with those systems is more costly. You need to remove all of the casework, get the steam piping out, get in the new, taking down ceilings, etc. Going with a unitary system, it's primarily just a loop of piping with a duct work centrally located in the individual classrooms or spaces. Another primary difference is that because you're using air you have a large amount of air handlers and heat exchanges that you're using. So last year we were creating a penthouse above administration, and the latest price we submitted in September was to split the height of the old cafeteria/gymnasium and building a penthouse inside the cafeteria to house most of this equipment. So yes, it is tagged with an initial higher price because of everything we have to do vs. a unitary system where you'd primary be looking at piping and equipment in a room.

Dr. Phetteplace

The other advantage of the unitary approach I think is that the switch over would probably be a lot smoother too. You don't have to do anything much in the boiler room, for instance.

Mr. Harrison

I think to answer the question about apples to oranges, the unitary system in the room has less air distribution movement and noise factor compared to the displacement ventilation. If we were asked to design a unitary system we wouldn't do it that way because we wouldn't be able to meet state standards. We would do it as we've with a lot of other jobs, where they put the unit out in the hall. That kind of unit is still going to be less costly than the displacement to some degree, but not nearly as much as putting the equipment in the room. So there's an orange to orange comparison if you look at unitary out in the hallway with ductwork vs. displacement with ductwork to the rooms. But then it's totally apples to oranges when you put the unitary equipment in the room, and it's something we couldn't do.

Mr. DuBois

One of the things we haven't talked about yet is the unitary solution out at the exterior wall is like the unit ventilators you have now and it would also be multiple air intakes. We'd want to centralize the air intake and would probably want to have a dedicated outside air unit that would be distributing to all these heat pumps that were individual located out above the hallway. Once it gets to that point, it starts to look more like the displacement system without the thin tub. So the \$20 a sq. ft. in Dr. Phetteplace's report is more of the total unitary unit ventilator type swap out scenario... and from what I've been hearing from the committee, I don't think that's the way we want to go.

Alderman McCarthy

The cost per sq. ft. for a project that doesn't involve structure and that much in the way of finishes except for ceilings is high. And I think that's what's causing some of the agitation that people are having with this. We're up close to the cost of construction for mostly just replacing the mechanical system in the final estimate.

Mr. DuBois

But the latest construction costs are \$250 per sq. ft. We just bid out a 10,000 ft. school that was close to \$400 a sq. ft. You can't get a \$100 sq. ft. school anymore.

Mr. Dowd

Were you talking earlier about digging wells in the parking lot?

Dr. Phetteplace

You can dig them anywhere, but certainly under the parking lot is a legitimate place to put it.

Mr. Dowd

Is part of this cost removing and replacing the asphalt? Are we going to repave all the pavement?

Mr. Harrison

The way I've costed it out, is the asphalt behind the cafeteria would be removed, replaced upon completion of the project. But the well field is actually further outboard towards the back of the school. But we do have to bring the lines in to that location. And you may not want it, but we've actually lowered the well head into a manhole with a cover on it to protect it. That's all stuff we can discuss.

Alderman Teeboom

I have not had a chance to read the report. It says here that in your opinion a significantly different approach should be taken. Could you elaborate on that?

Dr. Phetteplace

Basically what we should be doing a unitary equipment approach spread out into the zones. I do say in the conclusion what a significantly different approach is.

Alderman Teeboom

What exactly did you look at when you reviewed the design by Turner?

Dr. Phetteplace

All the drawings that were sent to me. I really focused in on their decision matrix of what they saw as the advantages and disadvantages of different components. Because when I look at the design, which I did do, it's such a radical departure from what is normally done that I wanted to understand why they were thinking that.

Alderman Teeboom

There was a question raised about air quality; CO2. I think it was Turner who claimed that the displacement system will provide better air quality than the distributor system.

Dr. Phetteplace

In theory it probably should be able to. But you're retrofitting the displacement system and don't have the ideal situation (ceiling height, etc.).

Alderman Teeboom

We don't have displacement systems in any but 2 schools. So you're trying to retrofit into a school, a system with a fairly high cost. At one point it was \$6.5 million per school. It has come down to \$5.9 million. So again, would the displacement air be better in that system after you retrofit?

Dr. Phetteplace

I don't think I can answer that. It would be curious to actually make some air quality measurements in the schools where you have already retrofitting and compared them to other new schools that have mixing systems that use CO2 monitoring and adequate ventilation. You can't compare it to schools that don't have adequate ventilation.

Alderman Teeboom

So that brings me to Gorham High School in Maine. It's a closed loop system, uses 136 heat pumps, is about 2-1/2 times the size of our elementary schools and has 13 air handling units. So, they have somehow managed to do some distribution of air.

Dr. Phetteplace

It sounds like they are doing a dedicated outdoor system. It's like the school that I mentioned in upstate NY.

Alderman Teeboom

They did the whole construction for \$2 million for the system.

Alderman McCarthy

But as was discussed when we got the original numbers from Turner, that for a building that didn't yet exist and didn't need any demo or reconstruction.

Alderman Teeboom

I'm coming to that. Have you at all looked at the cost projections of Turner's design putting this displacement air system into a retrofitted system? Have you looked at those costs at all?

Dr. Phetteplace

Yes, I have.

Alderman Teeboom

Did you find them to be reasonable? The \$5.9 million and the \$6.5 million per school?

Dr. Phetteplace

Well on a sq. ft. basis, they're like 2-3 times what I would expect if you did it with unitary equipment. But make no mistake about it... it's much more expensive to do a retrofit than to do a new construction of these kinds of systems. A retrofit could be twice as much.

Alderman Teeboom

So the \$2 million could be \$4 million?

Dr. Phetteplace

Well you're comparing a different school.

Alderman McCarthy

What's the sq. footage of the Gorham School?

Alderman Teeboom

Roughly 136,000 sq. ft. or 2 ½ times our schools.

Alderman McCarthy

That's a high school and to get an apples to apples comparison you'd have to factor out things like auditoriums and gymnasiums, which are big, easier spaces.

Mr. Harrison

Another bigger factor is that Gorham is new construction with twice the sq. footage with half the heat load of what we're dealing with at Fairgrounds. So the mechanical systems are roughly the same capacity for 2:1 sq. footage.

Mr. DuBois

Two other points... that school was built 5-6 years ago. The other problem is that sq. ft. numbers can be very deceiving. You take the same system and put it in a 200,000 sq. ft. building and your cost is going to drop dramatically. There is not a direct correlation... it never is.

Alderman Teeboom

Dr. Phetteplace, is that why you said a different approach should be taken?

Dr. Phetteplace

Well, I just think that on a sq. ft. basis a different approach will yield a lower cost.

Alderman Teeboom

When you did your peer review did you estimate a cost for retrofitting Fairgrounds using the distributor approach?

Dr. Phetteplace

No, I only cited some costs of schools with similar size in other parts of the country. A couple of them were actually smaller than the Fairgrounds school. The schools are smaller, but on a sq. ft. basis we're talking about \$20 a sq. ft.

Alderman Teeboom

Fairgrounds is about 68,000 sq. ft. so we're talking about \$1.2 million. And that's another problem I have. Alderman Tabacsko asked an interesting question about the decision matrix. Where would you start? Turner said displacement system. Where would your decision start?

Dr. Phetteplace

If you think you want to do geothermal, I would start by looking at a unitary equipment based approach.

Alderman Teeboom

So we're talking at this point of \$1.2 million vs. \$5.9 million. Am I correct?

Dr. Phetteplace

You can't make a one-to-one translation in between what I've told you what works in Illinois to what works here. But I think it would be less.

Alderman Teeboom

You said \$20 a sq. ft. which is a complete installation of the distributor system in Illinois.

Alderman McCarthy

We have to decide what we're going to worry about cost or air quality first. If we decide to go with geothermal it's a cost decision. If you decide to go with displacement or not is an air quality decision.

Alderman Teeboom

That's the question I asked earlier and people keep repeating it without backup. The system you're talking about has never been built anywhere in the world.

Mr. DuBois

Most mechanical systems have never been built anywhere. The system in this building is unique to this building.

Alderman Teeboom

Let me rephrase it then. An air displacement systems married to a geothermal system... has it ever been built?

Mr. Harrison

It has no relevance. One is a heating system supply and the other is a method of air distribution. Where the air distribution gets its energy from, it doesn't care... as long as it gets its energy.

Alderman Teeboom

The exact words of the minutes said, we want an air displacement system matched to a geothermal system. You didn't object to it then.

Alderman McCarthy

That's what some members of the committee have said. We want the air quality aspects of the air displacement system and the cost saving aspects of the geothermal system and are trying to find a rational way to do that, that doesn't result in exorbitant costs.

Mr. Hallowell

I know what you're saying, but I also hear Dr. Phetteplace is saying that it does matter somewhat because of the temperature of the source water that you're using. You admitted you're doing things differently because you don't have the same thermal output from the water that you would from a boiler. So it does matter which system you're using.

Mr. Harrison

But we do that already for other alternatives.

Mr. Hallowell

I'm not arguing that you haven't done it before. I'm only arguing with your premise that they aren't connected to one another. They are indeed connected to one another.

Mr. Harrison

We're the consultant to do whatever you want. If you said to us do the cheapest system you can, we would do it unitary. If you said put in a unit displacement system because you want better air quality, that's what we'd design.

Alderman Teeboom

I understand that. Has anything you've heard changed your approach considering this air quality discussion?

Dr. Phetteplace

No, not really because this is not the first time we've discussed this. I've met with Shawn and Turner for hours and discussed this. My opinion is that if others can achieve acceptable indoor air quality without going to displacement ventilation then we ought to be able to do it here.

Alderman Teeboom

How much have you charged us so far for your services?

Dr. Phetteplace

I keep it all in Quick Books and will send you a bill at the end of the month. I'm guessing it's maybe about \$5,000.

Alderman Teeboom

Would you have any reservation recommending to this committee that they proceed with a unitary distributor system design?

Dr. Phetteplace

No, I don't have any reservations, but if they have reservations then they really need to clear that up themselves.

Alderman McCarthy

If what we're limited to is the budget that's in front of us right now, my advice to the committee is replace the boilers and do not worry about operating costs of the buildings. We are looking at what it takes to replace a long term operating cost with perhaps some additional capital costs. If we're only going to look at the construction costs in a vacuum and we want to minimize that, we can do that very easily and quickly... and make no increase in air quality except possibly get to 15 CMF and leave the operating costs exactly as they are and continue to consume fossil fuels.

Alderman Teeboom

I did not hear that here. I heard a figure from Dr. Phetteplace of putting in a system for \$20 a sq. ft. which is \$1.36 million.

Mr. Dowd

I don't think we heard that.

Dr. Phetteplace

I told you that that was an experience in other places. And I believe I said that I can't tell you that that will be your experience here. Those figures are a year or two old and in Illinois where labor costs may not be as high as here. I can't tell you what the sq. ft. cost will be but I think it will cost less than the current plan you have.

Alderman McCarthy

I don't think anyone disagrees with that.

Mr. Haas

My perception of how this proceeded was that we had used Turner in the past and thought they did a great job. My suspicion is that we asked them to put together an air displacement system and we led them down the path of what we thought we wanted... and that's what they gave us. I'm hearing that people believe a unitary system won't create the desired air quality and I'm wondering if anyone has looked at unitary systems to confirm or deny that these will or will not meet air quality standards. If you say design me a system that will give me good, clean air quality at a reasonable lifetime cost, that's a different statement than saying I want an air displacement system at the lowest long term cost. Has anyone done any studies that say unitary systems don't meet NH standards for schools?

Mr. Harrison

They can provide quality air, but they have to be done in a fashion that meets all requirements including noise criteria. And that is the one thing that would take the units out of the room. Unitary equipment in the room is something we couldn't do to meet the criteria. But when you take it out of the room, the cost advantages are degraded significantly.

Mr. Haas

Which manufacturers of heat pumps did you look at and did they meet the standards?

Mr. Harrison

There are many and they'll all do the job.

Mr. Haas

I think the concept of drilling a test well is a good idea so we know what we have for water. I guess I'm looking for more specifics as well. I believe you have done the task you were asked to do which was to provide us with a good air displacement system.

Alderman McCarthy

Let's go with a simple question... why is it that Turner advises the use of displacement air systems in the advantage classroom?

Mr. Harrison

Because they do better than meet the standards. There are many ways to meet acceptable air quality, but our experience says that this is better than the acceptable level. We've done measurements, smoke tests and studied how it works and it does provide better ventilation than other systems. That's the reason.

Mr. Dowd

I read that they are going to increase the standards because they found that even the existing standards are a detriment to education. And these schools were not designed to have optimum air quality.

Mr. Hallowell

When they say they're going to tighten up regulations, I would venture to say that the standards in NH might be a little higher than say in Arkansas. We have a BTU per sq. ft. per year cost now for Fairgrounds. What do we project our percent reduction would be in that school?

Mr. Harrison

Well, virtually nothing. In fact you'd increase the amount of BTU's you'd use because you're going to increase the ventilation. Again it's apples to oranges. If you compare BTU's that's heat and you're still going to heat the building and the ventilation air at the same rate. That's dollars. Right now you're making BTU's by burning gas and if you put in a geothermal unit you'd be making BTU's by burning kilowatt hours.

Mr. Hallowell

So, Dr. Phetteplace, what is table 2 on page 11 supposed to show me then?

Dr. Phetteplace

That's their purchased energy in terms of BTU's per sq. ft. per year and would include gas and electric.

Mr. Hallowell

So I guess the question is what percent of the geothermal will take up the energy cost?

Mr. Harrison

How much of the energy is going to come out of the ground? I think it's about the same... no difference.

Mr. Hallowell

So it's about the same level of reduction that he talks about...I think it was 30% on average.

Dr. Phetteplace

The energy consumption is more like about 50% reduction or greater, but the cost reduction is not as much.... Because electric is more expensive.

Mr. Hallowell

So 50% reduction of energy use from other sources...

Mr. Harrison

The difference is between the go into unitary or go in the centralized methods or decimal points... very little difference.

Dr. Phetteplace

I would not agree with that

Mr. Hallowell

That's what I was getting at. Can you expand on that?

Dr. Phetteplace

The unitary approach provides ideal zone control so you don't have equipment fighting with each other. So in the end that's how you save all the energy with geothermal, by cutting all that out. Sure you have variable speed drives on your displacement ventilation system. But as soon as you start turning those variable speed drives down, you think you're saving a lot, but you're not saving as much because your efficiency goes down. Bottom line, when you factor all that together you're just not going to get that kind of efficiency with a central system. And that's why people are building heat pump systems.

Mr. Harrison

The savings we get from going to the traditional mixing system, which is more expensive to operate down to the displacement one makes up for that so we're back to about equal.

Dr. Phetteplace

My gut feeling is that you're not going to get back to the same level.

Mr. DuBois

Forget about comparing unitary vs. air displacement. You'll see a savings but it will be eroded on both systems based on code and the number of air changes that are required in schools today, you're going to be moving, treating and heating more air than you currently do today. So it's not a straight relation. You're going to have to move a lot more air in that school today than ever before, with a cost attached to it.

Mr. Hallowell

If we were sitting here and Turner were to tell us that having an air displacement system with geothermal would cost \$100 million as opposed to \$2 million to do a unitary system that Dr. Phetteplace is suggesting it would be a very easy decision. We're not at that point. You have restraints... they're both costs and restraints and we're trying to balance those. And I think the systems are far enough apart that it's a decision has to be made. But it's not a slam dunk so that's why we're struggling with it.

Alderman Teeboom

I think it is a slam dunk. To get an estimate of what it would cost for the unitary approach, could that be done at this point?

Dr. Phetteplace

You would have to bring the design to a point where it could really get an estimate and Turner would be better qualified to determine that point. I can make the sq. ft. estimate tonight, but the confidence in those estimates is not very good. So the more detail there is, the more realistic the estimate will be.

Alderman Teeboom

There is a big cost difference and I would be interested to know the cost of the unitary system.

Alderman Tabacsko

Have you determined that the unitary in-room solution is not viable due to code?

Mr. Harrison

It's the noise issue.

Alderman Tabacsko

So if we're looking at a unitary system to compare to, then it's going to be something which is physically located outside the classroom, which gets us closer and closer to the displacement system cost. And you're saying that the unitary system that was not in the classroom would still come in some factor under the displacement system?

Mr. Harrison

We haven't done a detailed estimate, but I guess it would be about \$600,000 less. Don't write that number down too quickly, though.

Mr. DuBois

The unitary system that's outside the classroom that has remote monitoring that accomplishes the air quality and sound requirements we want, is not \$20 per sq. ft. It's more like \$35-40 per sq. ft. by the time we're done actually installing it.

Mr. Hallowell

Let's say by some miracle you had a system that could meet the noise standards... what's the reduction in cost? Is it the \$20 per sq. ft.? I'm saying if you put a unitary system in that allowed people to individually control the rooms, what is the cost savings of doing that system?

Mr. DuBois

I assume the only way you can get a \$20 a sq. ft. system is to have individual units standing in the classroom like the unit ventilators you have now. And that doesn't give you the air distribution for good air quality or low noise levels that you want. So you have to add in some duct work to place the unit external to the classroom and that adds to it.

Mr. Hallowell

But if I look at Dr. Phetteplace's report there are schools in Illinois that have unit ventilators in the room that were just built. Does that mean that they're not meeting the air standards?

Mr. Harrison

I believe they're probably bringing in the correct amounts of fresh air. It's probably the noise issue, which is a newer change beyond the fresh air requirements.

Mr. Hallowell

If we could just ignore the noise factor for a minute and you didn't have to do any duct work... is that \$20 per sq. ft. in your mind, or do you have a number? Is it a \$1 million dollar savings? A \$2 million dollar savings?

Mr. DuBois

You're going to easily be over \$30 per sq. ft. and you probably could be approaching \$40 for a unitary system in the room. If you put like unit ventilator heat pumps it would be closer to \$30.

Mr. Hallowell

Is that the installed cost?

Mr. DuBois

Yes. But I'm going to caution you that in that school it's going to be a lot more than \$30 because of the conditions there. There are so many variables and I don't know what they did for the \$20. A unitary system is going to cost you less. There is no doubt about it. Our charge was to come back with a price for displacement air based on the systems that were developed on Fairgrounds and Amherst Street using geothermal. If the committee wants us to come back to you with a unitary system, that's what we'll do.

Alderman McCarthy

My concerns about doing it with unit ventilators are the maintenance costs; people deliberately and accidentally blocking them so air is restricted; equal fresh air throughout the room and the noise issue.

Alderman Teeboom

I agree with that. I would suggest that we install in a wing at Fairgrounds as a test before we do anything. I think noise is an issue. Even if I look at \$40 a sq. ft. it's \$2.72 million. Maedl said he'd do the job for \$2.2 million. So no matter how I look at it, it's half the cost. Half the cost. That's a huge difference and I'd like a response to that.

Mr. DuBois

Once again, you asked us to price a displacement air system, which we did. No one is arguing that you can do a unitary system for far less. It's a philosophical discussion you're having here tonight... whether you want displacement air or you want unitary system in each classroom.

Alderman Teeboom

Last Tuesday we took a vote that said the Board encourages you to proceed with a conventional system. That vote was 8-6. The Board needs 10 votes to approve a bond. You have \$2.5 million dollars with which you can do things. There are discussions about noise, which I agree with. The questions about air flow and air quality can go either way. Maybe we can save a significant cost by having a test in one wing, which I asked for weeks ago.

Alderman McCarthy

Alderman Teeboom, we're not going to do that.

Alderman Teeboom

Then forget the whole thing and go back to your boilers. You will not the money approved for \$6 million dollars per school.

Alderman McCarthy

The money is there for this committee because this committee saved it from the high school project. And I have no intention of throwing away \$2 million of the taxpayers money on a geothermal system because it's neat if I don't believe that's it's going to provide the right air quality and noise level in the classroom. I would much rather Band-Aid the current system and let it sit there until a Board with more foresight comes along and replaces it with something that meets that criteria at the same time. If we can find a less expensive system I don't think anyone will argue with that. I think there is a substantial discussion as to whether the unitary system that is proposed meets both the air quality and noise standards that we want to have in our classrooms.

Alderman Teeboom

Is that true Dr. Phetteplace?

Dr. Phetteplace

I know we can meet the air quality. Whether or not we can meet the noise needs some more investigation.

Alderman Teeboom

Would you recommend the test?

Dr. Phetteplace

Sure. That's one reason I recommended that we visit the schools that have them in there and you can hear them yourself.

Alderman McCarthy

We certainly don't need to sink a well to determine whether a piece of unit ventilating equipment generates too much noise or not.

Alderman Teeboom

No, you need to dig a well to find out if you meet the water quality to do open loop, get enough heat out of the thing and tie it up to a ventilator to find out about the noise. This is an engineering job and takes an engineering attitude and approach.

Mr. Hallowell

That's why we've hired experts. I'm not an engineer, but I think I can look at data. I guess I would suggest that there must be places in Nashua that have a unit ventilator installed of the ilk that we might be thinking we'd be putting into... I don't think the citizens of Nashua are going to think too kindly if we take a trip to Illinois.

Dr. Phetteplace

And you've got to see units that have been designed to handle the noise issue. I agree that going to Illinois sounds expensive, but if you look at the money on the table here, it's nothing.

Mr. Harrison

I've looked at numerous pieces of equipment to try and find the solution for other clients as well... but have not been able to find any. The Bard unit that Dr. Phetteplace brought to the table is the best that I've seen and they have an extensive test report of their own.

Mr. Dowd

If we could find a place in New England and take a bus or something, we'd be talking peanuts. We're going to dig a well.... how much does that cost?

Mr. Harrison

It depends what you're going to do. My recommendation is that if you're going to put a test well in, you put it into the design standard that you have to use later as one of your production wells. It's probably around \$55,000-\$60,000 and another \$20,000-\$30,000 for the testing that goes along with that.

Dr. Phetteplace

If you were doing open loop, a test well is not going to be nearly as expensive.

Mr. Dowd

Dr. Phetteplace, if you found the right kind of water that could go with an open vs. a closed loop, would you save that \$60,000?

Dr. Phetteplace

You'd save a lot more than \$60,000.

Alderman McCarthy

What's the reason that we're assuming we want to go to closed loop?

Mr. Harrison

Well, closed loop has less environmental risk associated with it than open loop.

Alderman McCarthy

Is there difference in the way DES looks at open vs. closed loop?

Mr. Harrison

They did recently pass a law that restricts the use of glycol in ground and all wells that use it must be fully grouted.

Mr. DuBois

I suspect that as this becomes more popular, more and more restrictions will surface.

Dr. Phetteplace

I would argue that there's nothing environmentally unsound about an open loop system. I'm taking water out and putting it back. It is allowed and is regulated by different processes.

Mr. Haas

I think legislation in Massachusetts is moving towards prohibited what you're describing as a well that bleeds back into the environment. They are moving towards prohibited it.

Mr. DuBois

Let me check with the suppliers. We're working with St. Paul's right now. I don't recall a situation but I'll report back to Shawn if I can find a location for you.

Mr. Haas

You did what we asked you to do. But I guess in order for me to do my due diligence, I'd like to be able to say that we looked at the unitary system and I'd love to be able to see or hear the specs on how much noise it really makes. We may ultimately decide that it makes more sense to spend twice as much money. But I'd like to have some baseline to compare apples to apples. Clean air and the right sound levels.

Alderman McCarthy

If we'd simply asked you to design a system with the best possible air quality, would you have come back with a displacement air system?

Mr. Harrison

Probably.

Mr. Haas

Because that's what they do. I'd be shocked if came back with anything else.

Alderman McCarthy

The reason we're here, is that Turner and at least some of us believe that those systems do provide the best air quality.

Mr. DuBois

It would be helpful if we could find installations that have been in place for a number of years. This equipment is essentially a fan, a motor and a refrigerator all in one. It may have acceptable noise levels to start, but so did the unit ventilators in those classrooms. In time the motor squeaks, the fan squeaks, the refrigerator grumbles.

Mr. Dowd

Going back to Alderman Teeboom's comment... if all we're going to use is \$2+ million then I would suggest that we do all 3 schools with a conventional boiler and call it a day and end this argument. If we're going to go with any type of geothermal system it's going to cost more than that for 1 school. As far as a test is concerned, we do one school and if it doesn't work out we alter our approach for the other 2 schools. We have 3 schools to do and \$2 million is not going to do it.

Mr. Smith

I would add that we have a few schools to do down the pike as well. Whichever we do first, we're going to learn form.

Mr. Dowd

As part of the Facilities Committee I've been taking pictures of all the boilers so we'll have a little scrapbook of what we have to do next.

Mr. Smith

As a result of the meeting on Monday it was apparent to me that probably do want to do some studies of the hydrology geology of the sites to determine the water quality and find out what the bedrock is, etc. So I contacted a local firm in Manchester and spoke with someone who's been involved in quite a few geothermal installations. He suggested that we contract with someone to do a paper study first of what's documented in the records at this point. When that's completed to do a test well, which would be subsequently used in the eventual system that was installed. He said the cost of that first study would be \$13,000 to \$14,000 and for digging the well about \$30,000 to \$60,000. If you want I'm prepared to open an RFP and get some bids.

Alderman Tabacsko

Does that cost all end up getting recovered in the cost of the working wells, ultimately?

Mr. Smith

The well would end up being used, so that cost would be recovered.

Dr. Phetteplace

And it could greatly improve your position when it comes time to bid. If you don't have that information to give the driller he's going to bid higher.

Mr. Hallowell

The \$13,000-\$14,000 is for all 3 schools or for each site?

Mr. Smith

I got the impression it was for each site.

Mr. Hallowell

And then I assume we'd have to do a test that would be sufficiently different for each school?

Mr. Smith

Correct.

Mr. Haas

Your design is proposing closed loop systems. So why would we drill a 15,000' well? You're not concerned with the quality of water quality or the volume of water that's going to come out of the well. You're concerned with the number of loops and feet you have for the tonnage of the building. So why drill a test well?

Mr. Harrison

If we're doing a closed loop the test well is irrelevant. The test well is for an open loop.

Mr. Haas

So if we accept your thought process that a closed loop is the best way to go, then I would suggest that we don't need to do a test well.

Mr. Harrison

It's our advice that a closed loop has less environmental impact and less future risk. But an open loop is less expensive and is not prohibitive. So it's your decision based on the advice that you're given. We'll go either way you want as long as you understand the risk factors associated with it.

Mr. DuBois

But a test well would also show you whether you'll hit significant water at a lower level.

Mr. Harrison

A test well could reveal that there's no sufficient water in the area because you're hitting very dry rock and can't get the volume out of it to do that open system.

Mr. Hallowell

Essentially you have to drill the hole anyway.

Dr. Phetteplace

With a closed loop, I would still drill a test well because you need to know the geology. You wouldn't do it on a residential job, but on a job like this you would do a test well.

Mr. Harrison

We stopped doing test wells for closed loop because we weren't finding variations in the rock enough to justify the cost.

Dr. Phetteplace

But it becomes one of the wells on your system.

Alderman McCarthy

Do we understand what we're doing in terms of next steps? Can you look for some sites to visit?

Mr. Harrison

Gorham is a very good one to look at.

*Visit to Gorham School***Alderman McCarthy**

Do we still want to make the visit?

Alderman Teeboom

These people have done it and it would be good to see it. But if we're going to do the kind of investigation and testing that we're now talking about, maybe we don't need to see Gorham. I only suggested it because I was desperate to look for a comparison. I'm retired and have lots of time. I don't think the whole committee has to go. I'd like to visit Gorham with Shawn and talk to them about what they've been done. But if all the testing that you've just talked about is going to be done, then maybe we don't need to.

Alderman Tabacsko

I don't know if I'll have the time to go, but if others on the committee could go I would encourage it.

Mr. Smith

Would it help any if I pushed it out for a month or so and gave you time to work it out?

Mr. Harrison

Maybe I can find some school closer by that I'm not familiar with.

Alderman McCarthy

Why don't we try to do it on a Friday (everyone seems to prefer that day) sometime in November that people can do. It might be worth going to see it. That's not a completely unitary system, is it?

Mr. Harrison

It's a mixture.

Alderman Tabacsko

Do you already have the air quality tests?

Mr. Harrison

I don't know if they've ever done CO2 tests, but it wasn't a job that I was involved with.

Alderman McCarthy

So I think our remaining item of business I back to the approval of the contract with Turner. I don't know whether the contract will change based on what we decide to do. This is a standard document for an architect and honor contract and whether we use displacement or not doesn't seem to influence how that's going to work. The only circumstance by which we wouldn't approve this is if we weren't going to engage Turner to do the final design.

Alderman Tabacsko

I would think that we would want to go ahead and do this. How come we haven't done this already?

Mr. Smith

The school district had a contract with turner to get us to the point where we're at. And the money that was put aside for that has now been expended. It seemed like a good time to turn it over to the Construction Committee. This is the exact same contract that we used for the past 2 1/2 years and has gone under legal review.

Alderman McCarthy

And I note that the arbitration piece has been stricken from it as we typically do.

Alderman Teeboom

This doesn't put a limit on the contract. There's no limit on the fee. There's also no description of what's being done. There is a 7.4% percentage of the scope of work, but we don't know what the scope of work is.

Alderman McCarthy

When we set the scope of work, the limit is set.

Alderman Tabacsko

I think it would be timely to go ahead.

Mr. Hallowell

We've already spent \$114,000. Was the 7.4% adjusted? I mean the \$114,000 is in support of us designing and building this system, is it not?

Mr. Smith

My expectation would be that whatever the final scope of work, that \$115,000 (which is actually is) that we've spent would be part of that 7.4%.

Mr. Hall

Wouldn't we want to say that in this contract? It's a separate part of money that the \$115,000 came from.

Mr. Smith

Good point. We can add that.

Alderman McCarthy

I don't think we need to change the contract to do that, other than the \$115,000 was paid under the other contract.

Mr. Harrison

The other contract was essentially a purchase order for \$115,000. We had this contract, but it was never signed as far as I know.

Mr. DuBois

If you need it in the contract, we can put it in the contract. But as far as discussing it here... it's in the minutes and we can deduct \$115,000 off the total amount.

Mr. Hallowell

That's fine with me. I just wanted to make sure that the Chairman had the same belief that I did.

ALDERMAN TABACSKO MOVED TO RECOMMEND APPROVAL OF THE CONTRACT WITH TURNER BUILDING SCIENCES.

SO VOTED.

Mr. Dowd moved to adjourn. **So voted at 10:10 p.m.**

Submitted by Jacki Waters