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PERCEPTIONS OF RISK AND SOCIAL AND ECONOMIC IMPACTS

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I N D E X

P R O C E E D I N G S

DR. BREWER: Let's get the proceedings underway here.

Welcome once again to the second day of the joint panel meetings on Risk and Performance Assessment and Environment and Public Health. And, once again, I'm Garry Brewer, Chairman of the two panels and member of the Nuclear Waste Technical Review Board. I will not re-introduce everyone, since we did that yesterday.

Let me try to capture where we are in the proceedings, since we're kind of in the mid point. The first thing I wanted to do was to remind everyone of the purpose of this two day panel meeting by going back to some comments that I made yesterday at the beginning.

We're looking at socioeconomic impacts in two different terms, in terms of standard effects, which will be the major focus today, and in terms of special effects related to risk assessment, and more importantly, risk perception. And that's where we spent almost all of our time yesterday thinking about the theories, the methods, the problems, the opportunities that are related to the whole question of risk.

The basic point here is to explore the proposition that perceptions of risk associated with a repository lead to significant adverse social and economic effects or impacts.

That's the basic reason why we're here.

The purpose of the meeting, and the purpose yesterday, the purpose today, just to keep everyone on track as to why we're doing all of this, is to talk about, to explore, to ventilate--I don't know what the verb would be that describes this exploratory, is really what it is, activity, the methodological, the empirical, the analytical, and the practical problems that are involved in trying to link risk perception to impacts, to then the policies that follow from assessing an impact, and then trying to figure out appropriate methods and means of compensation and mitigation if something in fact does happen.

These are all technical questions. We have a panel of technical social scientific by and large experts who brought information and insight in response to the general purpose as I've just described it from yesterday's session.

Now, what I want to do is focus in on what is the third major task, or collection of tasks, that we've identified for the panel and for this activity of exploring things. And this is the rigorous socioeconomic impact analysis, what's all related to that, what does it mean, how do standard socioeconomic monitoring and forecasting activities relate to the assessment of impacts, the question of baseline studies, what is an appropriate baseline, what are the things that should be measured, was a question that

we got to a bit yesterday.

How do we separate out a true signal, that is to say suppose you have a repository, how do you separate out the signal of impact caused by the repository as compared to a case where you had no repository. That's really the essential question. I mean, what can you attribute to the repository either being there or not? And so the initial condition or the initial problem from an analytic and technical point of view is what baselines do you have in place before the repository comes along so that you can begin to see if in fact you've got some kind of an impact or a signal that you can then track back to the repository's existence.

There are other problems in terms of the specific kind of social, cultural and economic setting in which you're doing the monitoring. Las Vegan, Nevada and the region around it is unique, and we're heard much over the years about the unique qualities of this place. Well, it's literally true that everywhere is unique. But in what ways is Las Vegas and the region unique, in terms of the social and economic features that are operating here?

One thing that is often cited is that this is a tourism and destination kind of place, and that there's a high reliance on discretionary spending by people who don't live here. Well, that certainly has to feature in. Well,

what difference does that make and how do you monitor that?

Another aspect that's been called to our attention is that you have a highly transitory and mobile population, many of whom are elderly who are coming here to retire, and large numbers in terms of the fraction of the total population, where they're coming from and why they're coming to Nevada, and so forth, that probably also factors in. We want to hear the panel talking about some of the unique aspects of this place that ought to be taken into account by DOE--let's get back to why we're doing this--taken into account by DOE in the establishment of credible, reliable and appropriate baseline studies for monitoring against which subsequent impacts may or may not be judged.

Basically, what we will do for about the next half hour to 45 minutes is talk about impacts, and then move on to a discussion of what appropriate compensation and mitigation might be if in fact impacts occur, what kinds of systems would you have to have in place, what are the institutional mechanisms based on what we think we've learned about past behavior in this place and of the Department of Energy. Are there other instances known to the panel or to others where you've had adverse or beneficial--this is something we haven't really spent much time talking about--consequences where compensation and mitigation has been involved in large scale projects of one sort or another? Are there appropriate

other lessons from analogues out there that might be brought to bear in the case of the repository in Nevada?

And that really will then take us to about 10 o'clock or 10:15 and time for public comments. Again we have at least a half an hour set aside. Let me remind any of the members of the audience who wish to speak, that if you would please sign up in the back, we will do as we did yesterday; anything is fair game, making your own statements. If you want to leave written statements, if you want to ask questions of the board members, the panel, whatever, it's your time basically, and we make it available willingly.

And, finally, after we spend time talking and listening to the public, I thought it would be very useful to, by way of summarizing and trying to summarize what it is we all think we've learned here, I'm going to invite each of the panelists to spend a couple minutes, three or four minutes, at the conclusion of the day, where in your agenda it says closing comments and adjournment, basically to just summarize from their point of view what they think the board, the Nuclear Waste Board, and the Department of Energy, and more specifically the people in OCRWM, what is it that they ought to be thinking about as a consequence of our conversations, our explorations of yesterday and today. And that basically is how the morning has been structured.

I know. because I've been warned, that one or two

of the panelists have planes and may be having to leave early. We will try, as we did yesterday, to keep things on track, and perhaps the 11:30 adjournment, we may be even a little bit sooner than that. But that's roughly how things will go; no later than 11:30, to be sure.

Okay, with that, I'm going to get back in my place. Welcome to all. Let's pick it up where we left it off. I'd like basically to invite any one of the panel, as a way of kicking this thing off, to begin to just talk about what standard socioeconomic monitoring, baselines are all about and why in the world we even bother doing it. That's the question.

Does anyone care to at least take a whack at that by way of kicking off the morning session? Hank?

DR. JENKINS-SMITH: Sure, I'll take a stab at it.

The idea behind the monitoring systems is to identify where you have a change, a net change that is the result of some disturbance that you've put into a place, in this case, the construction of a nuclear waste repository. And you can imagine it just in general as some sort of an activity that's taking place and you're trying to understand what the impacts are on some community.

In order for monitoring to work, you would need to be able to know what the baseline would look like. The baseline would be an undisturbed case. It would be the kinds

of outcomes on whatever criteria you're measuring would have happened in absence of the disturbance that you put in place. So the baseline in the case of Nevada and Yucca Mountain would be what would economic, social, political, whatever measures you're tracking for purposes of understanding impacts, you would need to know what those would look like in absence of the repository.

The net impact would be measured by then comparing that baseline with what occurred as a result of incurring the disturbance. So then you would compare that baseline against the measures on those criteria with the repository in place. And this raises some interesting practical problems. We often don't have a baseline once we've introduced a disturbance; we don't have a control case. We can't have a separate Nevada in which there is no repository put in place, should one ever be built here, to compare with the one where one was built. And that has raised some very interesting methodological challenges for those of us who get concerned about these things, in that we have to try to estimate what that baseline would look like.

Now, there are a variety of strategies that have been adopted to try to address this problem, to try to measure impacts, these relative impacts over time, some of which I think are almost as misleading as they are helpful. You can simply measure trends over time. You can find those

criteria that you think are important and track them. In this case, you could think of some easy ones, such as level of economic activity in different areas, property values, perhaps some measures of mental health, and a variety of other factors, in flow and out flow of people, and stuff like that. And if you track that over time, before and after the advent of the disturbance, then you'd be able to try to make some estimates of what sort of net change took place.

The difficulty is we don't know what in those circumstances would have happened in absence of the disturbance, and so what you have to do is use some statistical techniques to try to see whether or not there are some changes in slopes or intercepts for those trend lines on those criteria associated with the onset of nuclear waste repository in this case.

Now, that's made difficult for a variety of reasons. It's been hypothesized by some that the effects of the repository may be felt well before the repository is put in place in an anticipatory sense. It's difficult to pick that out. It may be that some are lagged behind. One of the things that makes for the greatest difficulty here is that we know that all of those criteria that we would be attempting to track to look at impacts are driven by a whole host of different factors, some national trends, some things that would be unique to the region, many of which we only have a

partial grasp on in the social sciences, those of us who try to understand those things.

You've seen the difficulties we have with modelling many of these things already in yesterday's panel. So we're pushed into a position of attempting to estimate what the world would have looked like in the absence of this major disturbance over time, when we know that there are many other variables at play.

In economics, we attempt to use controls, similar areas without the disturbance, and things like that to try to measure to look at economic trends as sort of a base control elsewhere. Those have certain weaknesses associated with them. There's hard to find perfect matches in these kind of cases. It gets even trickier when we are attempting to find a match on the other kinds of variables, the less straightforward economic kinds of variables, because we don't know what drives those in many cases.

So I suppose I'm somewhat pessimistic about being able to do a careful baseline assessment from which one could do a reasonable comparison of impacts.

DR. BREWER: Doug?

DR. EASTERLING: I think Hank gave you a pretty good sense of the challenges involved in monitoring. I'll probably dig a little deeper hole and go back to the overhead that was on the screen a couple minutes ago.

You'll note that there's a decision coming up that the secretary has to make about whether or not the site is suitable, and one of the criteria in that decision is that any adverse socioeconomic impacts must be offset, or offsetable by mitigation or compensation.

So, in essence, there's a decision coming up where we have to predict what those impacts are going to be, and the forecasting task I think is probably ten times as complicated as the monitoring task, because now we're trying to go into the future and predict something based on either fairly non-comparable facilities that are put in other places, or based on theories that have somewhat unclear implications.

So I just want to kind of step back for a minute and talk a little bit more about the forecasting task, because that's where Nevada has put all its efforts in the past probably seven or eight years. We thought about monitoring, but we've not presumed that the repository will be in place and that the monitoring is the task at hand.

As we've thought about the forecasting task, we basically compiled a set of theories that we thought would in some sense motivate the fact that impacts could occur, and so we've talked about risk avoidance theory, we've talked about imagery theory that Paul developed, we've talked about stigmazation where you could have an entire area that's just

so poisoned in the public's mind that it's completely avoided. And then we've tried to test those theories in a number of ways; one by looking at analogous cases, as analogous as they could be. We mentioned Goiana yesterday. We've looked at TMI. We actually even looked at the test site to see what's happened there.

A second stream of research has looked at intended behaviors, which gets a little bit to what Steve talked about yesterday. We've asked people specifically what they would do under certain repository scenarios. And in that case, we've certainly acknowledged the fact that we're asking people about events that are so far in the future that they may not even be around, and so there's several complications there.

So we spent probably most of our resources in essence testing the theories, testing the theories about imagery and risk avoidance to see if they really hold water, and if there are direct implications with respect to impacts. And I think we found pretty good evidence about processes such as people avoiding places that have negative imagery, and about the possibility of a repository causing a place to be seen more negatively by the public.

That's kind of where we are. We're trying to take those same theories and apply that to the monitoring task so that as we go forward into the future, we can try to parse

apart some of what Hank was mentioning and what impacts are due to the repository, what impacts are due to natural fluctuations in migration by going back and also monitoring some of the concepts that come out of those theories like perceived risk, like imagery around Las Vegas, things that we think would predict repository induced impacts.

DR. BREWER: Does anyone care to follow up? The monitoring and forecasting distinction I think is really an important one, and also as I'm sitting here listening, you are getting to my concern about the unique character of this place, Las Vegas and the region. You know, if you had a repository in a place much larger or with different kind of industry, obviously it would be a different problem, and it may even get lost, the signal may just be completely lost.

Okay, pick up on that in a bit. Jim?

DR. OPALUCH: Yeah, I think that the distinction between forecasting and monitoring is important. But also there's an important linkage, that is, when you're going to do monitoring, you want it to be tied with forecasting. You want to do your forecasting thinking first, and then go to your monitoring, because you want to know what you need to monitor, and in order to know what to monitor, you want to know what the impacts are going to be. And so if you fail in your forecasting, you're going to be perhaps monitoring the wrong things.

DR. BREWER: Or monitoring everything in a mindless fashion just because it exists as opposed to having a theory or some understanding of what to look for.

DR. OPALUCH: Absolutely. I think that's a critical part of it.

DR. BREWER: I'm sorry to cut you off. I just want to be sure everyone's head is doing this, which is good.

Yeah, Elaine?

DR. VAUGHAN: I have a question for either Doug, Hank or Jim. How do you go about selecting the criteria on which you're going to monitor or forecast? You can imagine that an event like this could have a differential effect, depending on variability of the population. We haven't talked a lot about that yet, but I think someone said we shouldn't consider the public as a monolithic body. People's behaviors are constrained by their social cultural circumstances, and it's not just the tourist industry, and it's part of the region that one would be concerned about, but there are other kinds of population. So how would you make sure that you are looking at the criteria that could look at differential effects upon different industries or different population?

DR. BREWER: Doug?

DR. EASTERLING: What the state's done from the beginning is in some ways segment the studies, and so there's one set of studies that looks at rural populations, one set

that looks at urban populations, one that looks at Native American populations. Those try to get at some of the more psychological sociological impacts that Paul mentioned yesterday. Then there's a whole stream of research that looks at economic impacts. And even there we've segmented into things related to, say, the tourism industry versus the convention industry versus new businesses locating versus retirees maybe coming or not coming, and we've tried to somehow have at least consistent theories that would drive those impacts, taking into account the maybe differential sensitivities those populations might have.

DR. VAUGHAN: Doug, at what point do you consider there's an adverse effect? This is thinking from systems theory perspective. Whenever there's a perturbation in a system where you introduce something new, there's going to be a re-adjustment of the system. So that may be a natural adjustment to the situation. How do you decide there's really a long-term of significant adverse effect versus a natural re-adjustment?

DR. EASTERLING: We've thought about that.

DR. JENKINS-SMITH: Elaine, that is one of the most difficult questions that's out there, though, because if you put a repository, and suppose for a moment that all of the measures that we've taken of risk perception and intended behavior are in fact correct, that they really measure what

people would do, that would mean that if you build a repository here, a lot of people would leave, a lot of people who are adverse to it wouldn't move here who would have otherwise, it will change the kind of people who come here to vacation, in other words, you create a different world.

Every time we disturb that system, the kinds of people that we have to worry about in the future are going to be different than the sort that would have been there in absence of that disturbance. That's one of the things that makes the comparison of a base and an actual future very, very difficult. It also makes it very difficult to predict what's going on. I mean, one of the things that's clear from the imagery studies is that different types of people, people with different sorts of values are paying differential attention to, say, nuclear images.

So to the extent that nuclear imagery becomes associated with Nevada, that will change the kind of people who, if again these measures that we're taking of intended behavior are correct, would change the kind of people who would be attracted to coming here. That sort of natural adaptation to circumstances is something that we have to build into any assessment of future impact. I mean, we change the world. It's not the same people, by and large, that we would have to be imagining are in that future world for forecasting purposes, or monitoring for monitoring

purposes.

DR. BREWER: A point you made, Hank, I've often wondered about; how in the world can you differentiate in terms of nuclear image the case of repository, non-repository when you have 45 or 50 years of Nevada Test Site. I mean, how do you attribute the image to one and not the other? It's a question. Paul?

DR. SLOVIC: We've looked at that, because in studying imagery associated with Nevada and Las Vegas, one can ask people, you know, what's the first thing that comes to your mind when you hear the word Nevada. And a certain percentage of people will say something associated with nuclear.

You can also ask them if they know where the nuclear weapons test site is, and some do and some don't. Then you can look to see the relationship between knowledge of the test site and nuclear imagery, and so far, most of the--you know, there's a very strong correlation between knowledge of where the test site is, and having a nuclear image for the state of Nevada.

So it's pretty clear that up to this point, the nuclear imagery that we see for Nevada is coming from the test site. So there are ways through correlating with other sorts of knowledge that you can differentiate that.

DR. BREWER: Okay. And you're actually doing work on that subject?

DR. SLOVIC: We have some work on that. And while we're talking about imagery, let me just comment in terms of monitoring that I think monitoring for various kinds of impacts here is analogous to, say, medical monitoring for an individual's health. And you don't necessarily want to wait till they get sick and then detect their illness. You want to kind of look in advance to see precursors, you know, predictors of illness or problems.

So you monitor blood pressure and cholesterol and things like that. And we might see the monitoring of the imagery of Nevada and Las Vegas and so forth in advance as one of these kinds of precursor measures, and that can be monitored, and if one sees a shift in the degree in which people start to think of Nevada and waste and negative kinds of imagery then, you know, those are images. They may not have immediate economic effects, but they're not good signs.

DR. BREWER: Okay. So this is somewhere in between the discussion yesterday of risk perception, it's really the connecting tissue--I'm sitting here thinking about this--between where we were yesterday and the, quote, hard socioeconomic standard effects that people typically look at. Imagery is the thing that connects the two in your mind, or at least one of the things that would connect; is that right?

DR. SLOVIC: Yes. And also, because imagery is a softer variable and more subtle, but it also links back to other

variables which are not, you know, dollar variables. I think we ought to be careful not to put all the emphasis on economic impacts. We ought to think also about psychological and social impacts, you know, again as I mentioned yesterday, the way people feel about the place they live, the degree to which they feel anxious or threatened by what they see happening in their community or their region that they feel powerless to affect what they don't like. You know, it's very clear from the many surveys, you know, dozens and dozens of surveys that have been done, that people feel an unease and antipathy and many negative reactions towards nuclear waste.

Now, if nuclear waste is imposed upon them, I mean, they may not move, you know, you may not see it directly in the economic effects, but their whole internal satisfaction and ease with their environment may be significantly changed. There may be, you know, stresses that show up in social interactions and things like that. So I think we ought to be monitoring those effects as well, which, you know, there are community health monitoring types of systems that ought to be set up to look for those kind of effects as well.

DR. BREWER: A follow up question, and then I've got some hands here. Is there, in your experience, and there's a lot of experience around the table, is there agreement among social science professionals as to what an appropriate

collection of these kinds of tests and observations monitoring would be? We have a variety of things that are being discussed. Is it something where there would be general agreement that we ought to be measuring the kinds of things you're talking about, Paul, or there would be controversy or are the techniques fairly undeveloped?

DR. SLOVIC: That's a bit out of my area. I think there are people in the audience who I know of who are more knowledgeable than I about this, and maybe they'll comment on this at the public comment section.

DR. BREWER: I think it's an appropriate question for us to be asking, because from our point of view on the board, we've got to be suggesting to the Department of Energy, well, here are things that professionals generally agree are appropriate, there's agreement as to how you do it, there's agreement that you ought to be doing it. I mean, at some point we get back to that. That's why I raised the question.

Jim, and then Hank.

DR. OPALUCH: I agree with what Paul just said, and certainly there are people in the audience who know a lot more about this stuff than I do. But, you know, there's a whole social indicators kinds of things. I was going to make another point, and now it's slipped my mind. Maybe it will come back to me.

DR. BREWER: If it does, raise your hand. Hank?

DR. JENKINS-SMITH: I think that there are a substantial number of people who are working on what to measure for general purposes. But I think that when we're talking about a nuclear waste repository and the kinds of connections that we're talking about, we're essentially on the frontier of much of this. The stigma modeling, the social amplification of risk model, all of these are the theoretical connectors that allow us to construct, or are beginning to allow us to think about how to construct these sorts of relationships, and these are new models. They've been tested in a variety of ways, but certainly more remains to be done.

For example, with respect to imagery, I mean, one of the things that surprised me was that nuclear images, for example the images that people would associate with nuclear power, over half of them are positive--neutral or positive, not negative. So there's substantial variance within a population in how people are attaching values or valences to these kinds of images. For a nuclear waste repository, it's more negative. There's still a significant fraction of those images that were positive in both my research and in Paul's.

And as a result, you have to wonder about what it is about people that leads them to attach negative and positive images or valences to these images that they pick up about a place, and if there are differences, I mean, since we know there are, we have to wonder about how that plays into

who is attracted to or repulsed by a place to which these images become attached. And the model I think requires some more thinking.

My own research suggests that the critical feature is what it is that attracts people to a place to begin with. A new image matters only to the extent that it resonates, either negatively or positively, with what attracts people to a region in the first place.

As I mentioned yesterday, some of the research that Carol Silva and Gib Bassett and I are doing right now suggests that Florida is more susceptible to negative imagery than is Nevada associated with Nuclear waste, in part because of the things that people would impute to Florida. They go there to be out of doors and on beaches and things along those lines, and there a nuclear image may have more impact than it would in a place where people aren't going in there to hang out on beaches or be out of doors.

There are other things that are attracting people here, and that's not to say that it wouldn't have a substantial potential negative impact, no matter where it happens, but it does mean that the weight is differential and that part of our theorizing needs to be able to disentangle where the biggest negative impact is likely to be. I think that's where this kind of work needs to go.

We're still on the front end of it. I don't think

that we're in any position to say we know right now what kind of monitoring needs to take place.

DR. BREWER: Okay. Howard, and then Jim.

DR. SCHUMAN: A major difference between trying to predict a social system in the future and a physical system is that people are not passive and can take things in their own hands and change things. I would guess it would be particularly important to monitor group activity because, for example, the images people have, either there can be movements that counter those that bring out other aspects of Las Vegas, or of Nevada, or there can be groups that note something going wrong or something believed to be going wrong and publicize it widely. So I don't think it's just sort of something in a changing state of a passive sort, and the organizational potential of group action is going to be very important.

DR. BREWER: Good point, and it really gets to something Warner was saying yesterday about a small number of people who are passionate and able to organize actually having huge impact if they keep focused. So group activity, and that gets to Elaine's point, too, about differential publics, trying to identify who they are and to monitor in a range of things of the sort that Paul has been talking about and others. Jim?

DR. OPALUCH: Another thing that came to mind when Paul

was talking, some of these impacts kind of break the behavioral link, that is, people might be impacted because fewer tourists come here, and so there you've got the perception behavior, fewer tourist come, and then the impact. But there also may be impacts that are not associated with specific behaviors like that. I feel worse knowing that the repository is here, it makes me feel worse about my community, my life, et cetera, et cetera, and it doesn't have that kind of behavioral link.

So it may not quite fit in with the framework that was set up here, the linkage. And, you know, that's the concept that has been called non-use values, in a sense, is not a use associated with it.

DR. BREWER: It's just knowing it exists or knowing that it's been taken away.

DR. OPALUCH: Right.

DR. BREWER: Doug, and then Hank.

DR. EASTERLING: Just to follow up and kind of draw another distinction I think that's floating here but hasn't been said yet. We're talking about monitoring in some cases actual outcomes and trying to get a handle on what is the full range of outcomes, social, economic and cultural and psychological. In the other sense, we're talking about monitoring the predictors of those outcomes.

The choice of predictors will obviously come from

the theories and the models that we develop. You asked about is there a consensus on that. I think until the theories have been fully tested in literature, that's going to be an emerging consensus. I would hope there could be more consensus in terms of the outcomes that are important, but I have not yet seen, for example from DOE, a clear delineation of exactly what it is they think would be an important socioeconomic impact.

DR. BREWER: Hank?

DR. JENKINS-SMITH: Some of the impacts that don't appear, that don't turn into behaviors I think are quite important. One of the things that we've seen in the data that we have from people in Nevada is that they are very concerned about state autonomy relative to the rest of the country.

I mean, here's where we wander into the area about which criteria or which impacts we want to measure. Certainly when a state feels beleaguered, as this one does, what they perceive to be the imposition of a nasty policy upon them by people elsewhere, has an effect on the way they feel about the world. And the way that that happens and how it's perceived locally, regardless of what the actual mechanisms that brought it about, are important. They do affect how people feel about their world, their sense of efficacy and ability to control their world.

The problem is is that as social scientists, we don't know what to do with those. How do we take that into account? Here's a place where rather than compensation, mitigation or designing policies, that attempts to minimize this sense of sort of imposed unpopular solutions is probably a preferable route. I don't know that these things can be in fact mitigated. I mean, we've had enormous conflicts in this society over time in which we've imposed solutions on losers, the Civil War being an example. People do feel disenfranchised and this goes on in a society that has majoritarian principles.

How do we decide then how to manage that? Are we obligated as a society to mitigate or compensate everybody who's a loser in these kinds of battles, or how do we design mechanisms that minimize sort of the impact and the likelihood of these kinds of things? We don't have answers for that, and to the extent that we are now dealing with the policy that has impacts of those kinds, we're groping and struggling, and in fact these are value judgments about what sorts of things should be included.

And to the extent that we are dealing with value judgments of that kind, we're going to have some bruising fights, I think, amongst ourselves just as intellectuals trying to sort out what goes on there, and policy is going to be involved in bruising fights as well. There isn't a

consensus.

DR. BREWER: You're really getting us to the next topic, which is mitigation and compensation, but that's fine.

I had one additional question for the panel, at least. The whole idea of anticipating, you know, human beings sort of knowing and thinking about the likely existence of a repository, has consequences. It already has. People in the audience are here because they're worried about that. I mean, nothing has happened in an official sort of real sense, but there are consequences.

How in the world do we create a monitoring system that will take that into account? And that gets to Howard's point, too, about people being thoughtful, people not being machines, basically. Elaine?

DR. VAUGHAN: One set of theories that might be useful from psychology is decision making and choice behavior under uncertainty. Everyone's trying to anticipate or guess if the repository is here, and how might that affect my life. And I think that thinking of the literature on decision making under uncertainty, regardless of the probabilities that might be communicated to the public about the low probability of a negative outcome, that probably will not be the dimension along which many publics will make decisions.

And thinking about, for instance, if you wanted to develop a business, you may chose to be risk averse--I think

someone brought that term up last time, it's a very good point--and not locate within a certain geographic area because of the repository. Or there could be possibly population shifts. There's a large influx of people I know in California. We've looked at this, what happened in, let's say, Southern California. There's a cumulative effect of certain events, the cumulative effect of perceived increase in crime, the earthquake. These things in isolation didn't have the effect, but when people did have choice, they are starting to move out of California, and a lot of them actually coming to Nevada, knowing though, for instance, this is a likely event.

But it's interesting because the kind of people who might move here, for instance, a lot of Californians have high environmental concerns, I could imagine they would not move to an area, and I don't know what that circle is which would lead to heightened concern about a repository, but maybe it would change the demographic profile of the state, and that people will choose to move far enough away where their concern would be minimized.

So I think those kinds of concerns might be something to look at, the changing not just the numbers of the population, but the changing profile of the population in terms of geographic location. But the decision making under uncertainty, I think the key is uncertainty or perceived

uncertainty might be the model by which some individuals and communities might respond to this.

DR. BREWER: John, do you have a question?

DR. CANTLON: Yes. I haven't heard the panel discuss how one separates out the economic impacts or the perceived economic impacts of the coming repository from the key activity going on nationally now where the other 49 states are mimicking Nevada's looking to gambling and entertainment industries and duplicating it. You have that big competitive swing which is gathering momentum very rapidly. How are you working on that?

DR. BREWER: Let me go to Steve.

DR. KRAUS: I think one of the key methodological challenges that comes up when you talk about a monitoring system is, you know, how do you separate correlation and causality. In a real world complicated system like this, it's enormously difficult to draw causal inferences, which is what we ultimately want to do, and say well, you know, these changes are happening because a repository has gone in. You know, we're not in a situation where there are, you know, two Nevadas, one of which we can randomly assign to get a repository and one of them we can't. And I think it would be very difficult to set up some kind of, you know, control city, as Hank referred to that is similar in many ways to Las Vegas. I mean, Las Vegas is such a unique city and is

different in so many ways, even from other cities with legalized gambling, I'm skeptical about the extent to which that would work.

So I think our choice would really be to look at changes in Las Vegas over time. I think there are some ways we could set up a monitoring system to improve the probability that we could make some causal inferences. So obviously that's got to start with, you know, choosing our measures, what is it that we're going to measure. You know, there's been some discussion of that. Once we've got some sense of what it is in general that we want to measure, you know, property values or economic activity, we have to talk about specifically how do we measure those things, how do we get multiple measures of those constructs so that we're getting reliable measures of them.

After that, I think one of the keys is to start early and to measure frequently. So if you're measuring these kinds of variables on a monthly, or probably no more than a quarterly basis, that would give you a lot more leverage in ultimately making some kind of causal inferences. If you're only measuring these things on, say, a yearly basis and, you know, you start to see a decline in the Las Vegas population, well how do you tie that to, say, an accident at the repository versus other changes going on, the competitive environment. That's very difficult to do. But

if you've got measures on a monthly basis, it's a little easier to try to pinpoint, you know, what the causal relationships are.

I think the other thing you can do is that besides just looking at behavioral impacts, I think we've got to think of, you know, what's the process by which the repository being built would lead to behaviors that have consequence. And I think that that process would be mediated by changes in attitudes or changes in risk perception.

So along with a kind of behavioral monitoring system, if you also had kind of a tracking study of attitudes towards nuclear power and toward the repository, the extent to which people have nuclear imagery associated with Nevada, you could sort of see that as a mediating variable between the repository and the actual behaviors and you could try to link changes in those attitudes to changes in the behavior, and I think that would go a long way toward giving some leverage to making causal inferences out of correlation of data.

DR. BREWER: John, are you going to follow up on that?

DR. CANTLON: Well, I think of the Brazilian case where the competitors actually tried to use the incident to improve their own business. So one can visualize that kind of game going on.

DR. BREWER: Jim?

DR. OPALUCH: I think that this monitoring is difficult, obviously, but it's not impossible. Usually when you think about monitoring, you would think about, you know, coming to Las Vegas and measuring how many tourist dollars came in and the population changes and that kind of thing.

Another way of looking at it would be to go to the origins. You go to Los Angeles and Phoenix and other major cities where people come in from and interview people locally about what they chose to do and why they chose to do that. And that's another part, is the interviewing. You can ask people why they did things. You may observe populations declining and you may not be sure what that's related to, but you can actually go and ask people why they left. You could do interviews of people in Las Vegas and ask questions that would relate to their satisfaction with living here, whether they're planning on moving within the near future, and if so, why are they moving. So you can get more different parts of it, not that it solves all the problems, but it's a step in the direction.

DR. BREWER: There are two things that just have really occurred to me in combination of Steve's comments and yours, Jim. One is that the monitoring is not simply something you do until the repository is opened. It's something that will probably have to continue for the whole life as you're trying to assess as the population changes, circumstances change,

the world changes. So a monitoring system is not simply to check off the requirement and say things are fine, now let's stop. That's real clear from what you just said, Steve.

And the second thing that just struck me; typical socioeconomic data, as you and I know well, is usually gathered by governments for other purposes, and it's then kind of pulled together. You're talking about commercial marketing studies and the need to be thinking about, a very, very creative need because maybe you can get it without having to pay a fortune for it, different kinds of data by asking a very different class of question than is the typical kind of question you can answer looking at government collected data of one sort or another.

But for me, two things I think I've just learned; one is, which I hadn't thought about, long-term, it's going to go on forever, the monitoring.

DR. JENKINS-SMITH: And theoretically, we have reason to believe that changes could happen out in the out periods, I mean the event that takes place is the kind of thing we want to be able to track. We want to have data before and after, and once the thing is in place, one of the most interesting pieces of information is going to be how does perception change, how does imagery change before and after some event.

DR. BREWER: It's also clear that there's going to be a core of information that will be collected periodically,

quarterly or whatever it is. Then you also have to have the capacity in the monitoring system to add special studies or more focused studies or more intense studies based on things that you're learning in the process. So the monitoring system is a way of helping you learn about what in the world is going on out there.

DR. JENKINS-SMITH: That's right.

DR. BREWER: And by the same token, you may stop monitoring stuff when it appears not to be very important. This is an adaptive system that you guys are talking about, clearly.

DR. JENKINS-SMITH: It is.

DR. BREWER: Lee, and then Paul.

DR. WILKINS: Two additional thoughts. I hate to cast dispersions on the good citizens of Las Vegas because I know there isn't another one, but in fact there are a couple of other places in the state of Nevada that you might take a look at monitoring, one of them being Reno.

I realize that it is a community of different character. You know, there are lots of differences, but there are also lots of similarities. So it may not be just an issue of monitoring Las Vegas. There may be other parts of the state that you would want to take a very careful and quite similar look at and see what kind of comparisons you can get.

The second thing I want to add is is while it's very difficult, and in this sense almost impossible to get baseline data, I would suggest that as you do think about monitoring, if this is something you decide to recommend to DOE, that you take a serious consideration of going back and looking in a historical way, as almost an environmental historian might look, at news coverage of this area.

There is a discoverable record there that goes back before the facility was even mentioned. And while I would hate to say that you can place a lot of faith in that, because I genuinely don't think that you can, there are issues of imagery and trustworthiness and all of that sort of stuff that will in fact be in that written down discoverable record that's already there, it's been there for years, and is certainly able to be examined in kind of a retrospective way in light of the questions that we're asking now.

So there are some additional data bases, if you will, that you can avail yourselves of that may help you get a more rounded contextural picture of what's going on.

DR. BREWER: Before I get to Paul, I want to invite our chairman to comment on the differences between Reno and Las Vegas people. This is an insight story. John is a native of Reno. If you care to, sir?

DR. CANTLON: No, thank you.

DR. BREWER: Okay. That's why he's the Chairman.

Paul, did you have a follow up?

DR. SLOVIC: Yes, I want to raise the issue again of broadening the scope of impact, not just on the site itself or the region, but to again bring in the issue of transportation. So if we have a single site here in Nevada and we're transporting wastes from 70 or more sites around the country, what's going to go on on the transportation corridors in terms of their own sense of risk and stigma and particularly I think we can anticipate that there will be a lot of fuss made about property values along these, and there already has been in some cases, and we've got an analogy with regard to power line siting where people have argued about the potential health effects of being exposed to electric and magnetic fields associated with high voltage transmission lines.

And courts have ruled that you don't have to prove that there are any real health effects, and that's an area where there's a lot of scientific debate. All you have to show is that the market value of your property has been decreased because of people's, or decreased presumably because of people's fears, and you're entitled to compensation. So I think we'll see a lot of this issue raised. I haven't seen any careful analyses of what the potential might be for this type of impact.

DR. BREWER: That gets back to the business of natural

variation and then trying to ascribe the decrease in property values to the repository.

DR. SLOVIC: There's a lot of miles there in these corridors, a lot of property. I don't know what that potential is.

DR. BREWER: Yeah. Elaine and then Jim. Elaine?

DR. VAUGHAN: I just wanted to underline a point that Steve made that's so important for the board to consider, and that's you have to be extremely thoughtful about choosing the kind of techniques that you later will want to use to monitor or forecast. In the situation of depending on the techniques, for instance, if you want to do time series analyses, you have to make sure you have enough observation points. Steve said you have to measure often. I think that's so important.

There's other kinds of analyses, continuity analyses, you're looking at trends, you look at the introduction of an event, and then to see, I think Hank had mentioned before, how slopes may have changed. But you need a lot of data points for that, so you have to make sure that it's not an after the fact designing of a study to understand the impacts, that you do have enough observations.

Also, there may be models I'm thinking of from the environmental sciences, from ecologists who are trying to monitor the effects of various human activities on whole

ecological systems, and that's really what we're talking about, an ecological system a very complex social ecological system. We're looking for interactions among variables, we're looking for changes over time, and I think that some of the newer models, the spatial analysis of impacts from ecology might be useful here as well.

I think some of the simpler models where you're looking at one variable at a time will not be as useful here. So that's important to remember the complex interactions.

DR. BREWER: Is your reference here to the human dimensions of global change, human dimension kinds of things?

DR. VAUGHAN: Yes. And some of the ecologists who are really on the cutting edge of using statistical techniques and other kinds of design to look at complex systems and changes over time.

DR. BREWER: The Santa Fe Institute crew?

DR. VAUGHAN: Yes.

DR. BREWER: Okay. Hank?

DR. JENKINS-SMITH: Just back to that issue of transportation and its potential effects, some of us have been looking pretty hard at the transportation question and the potential impacts that would be associated with that. In a recent study that was done nationwide, we asked people who lived along potential transportation routes what they thought would happen to the value of their homes in the event that

spent nuclear fuel was transported through or near their community, and 65 per cent of those who responded said that there would be no change. About 1 per cent said that the values would actually go up, and 32 per cent believed that their values of their homes would drop. And of those who thought they would drop, they gave an average value of about $30,000.

So there is a fraction, certainly not a majority, but a fraction of the individuals along those routes who do believe, or who say they believe there would be some impact. Now, these data have to be taken with a degree of caution. Sometimes people are venting, they are opposed to such a thing and, therefore, they magnify the sense of impact. We certainly see that with the CVM analysis, the contingent valuation work that goes on in economics. But nevertheless, there are a fraction of people who are willing to say that values would drop, and Paul's point was that in a court setting, often what we've seen relied on are simple statements like that, in Koomis versus Santa Fe.

In my own state, the court relied on a telephone survey asking people how much they would be willing to pay for this property, and oh, by the way, if nuclear stuff is hauled by it, then how much. These are extremely bad data, in my view, to use for making judgments about real value, but nevertheless, the courts are doing it. And I just point that

out because we have some issues here that are a function of insufficiently developed theory and methodology that are in fact now having a real live impact on the way valuation goes, and I think that as a society, if we're going to continue to make decisions like that, we'd better invest a little bit in being able to do it better than we do it now.

DR. BREWER: Let me see if I take the point, and I think we've really moved to the next topic, the next collection of things that we need to consider, compensation and mitigation.

What you're saying is in the absence of good indicators, good monitoring, the courts are making decisions anyway.

DR. JENKINS-SMITH: That's correct.

DR. BREWER: And in your professional view, they're doing it with less than wonderful data.

DR. JENKINS-SMITH: That's right.

DR. BREWER: And less than really appropriate analysis. I'll put the words in your mouth. So the burden is really to connect up better the first topic of the morning, which is monitoring and forecasting systems, with the mechanisms to do compensation and mitigation. Jim?

DR. OPALUCH: There is some better data of that sort where there was a recent study I saw, actually it's surprising this is the first one that I've seen on the topic, where someone has tracked property values as a function of

siting some type of facility. I don't remember what facility it was, but they look at, you know, what was the impact on property values that the announcement that the facility was going to have, the ground breaking, and found some pretty interesting results on that.

DR. BREWER: But what were they?

DR. OPALUCH: They found that there was an impact at the time of announcement, but it was relatively small. The ground breaking had a larger, if I remember right, the ground breaking had a larger impact. And eventually the property values kind of came back up, so it was a relatively temporary phenomenon.

DR. BREWER: So there was a transitory phenomenon, and then it got back to something like where they were before; is that it?

DR. OPALUCH: Yeah, I think so. I believe that was the result.

DR. BREWER: It's interesting. At some point in the materials we prepared, there was the Goiana case, which has been referred to as having grave consequences. But then in *The New York Times*, that source of all elite wisdom in the world, there was a story only a week ago saying, in effect, that they're making lemonade out of the lemon by creating a tourist destination now on Goiana.

We noticed the same thing about a year or so ago

when we went to Sellafield in the UK, a place that was called Windscale where they had had a major nuclear event, bad event, and now it's become a--accident, thank you very much--yes, an accident, and the place has now been converted into an educational center where people actually pick it as one of the things they go look at when they're in that district.

The same story in Sweden. We were there in October, or December of this last year. The sites and facilities at Forstmark and Oskersham have been made into quasi tourist destinations. And so rather than having the negative, the immediate negative, there is the longer term positive.

How in the world do you account for that?

DR. JENKINS-SMITH: Are you suggesting that one mechanism for mitigation is for the nuclear facility to hire protestors to do colorful things outside the gates?

DR. BREWER: I'm not suggesting a thing. I'm just making some observations and comments. That's all.

Yeah, Gib?

DR. BASSETT: I don't know how to handle that either, but there is a large literature in the economics area on hedonic prices which attempt to capture decreases in property values around various sorts of facilities, prisons, chemical factories and so on, and they do detect property value decreases around these sorts of facilities. It gets

complicated, and it gets complicated for the kind of reasons that were described earlier, in that we're not dealing with a physical system, that the humans respond endogenously to what's going on, and they respond in a way, for example, in Gary, Indiana, incomes are higher than they would otherwise be, precisely because that's what's necessary to induce people to live and work in a less than desirable city.

Indeed, those income differences begin to be used as an indication of how undesirable Gary is. I mean, you have to offer higher wages to induce people to come in there. And the point is all of the effects are not necessarily captured in land values. There's these kind of income effects.

The other just comment that I'd just toss out here is I don't know anything really about EISs, and I think one of the problems that might exist is that the EIS type of process is project driven instead of problem driven. Some of the people around this table have written very insightful pieces I think that suggest that the project driven instead of problem driven nature of some of the kinds of analyses that's necessary with these kinds of projects really put significant constraints on not only what's done, but how the problem is posed to the public. And the way it's posed turns out to matter.

There's a report from Carnegie on risk in the

environment from 1993, and they have eight hypotheses and their second hypotheses here, just to tie together some of the things from yesterday, is the lack of scientific knowledge is not what blocks the public from thoughtfully considering most highly scientific issues. Far more important than facts and figures is a framework within which the issue can be assessed. And when the framework is kind of restricted to a project driven, narrowly focused, Nevada, Nevada, Nevada perspective, it's not surprising that the kinds of difficulties that we should see should start popping up, and we would have a difficult time handling them.

The EIS process which was more problem driven would not only be useful for policy makers, it might be useful for that public as they understood what the nature of the problems was. Doug can talk about it; he did a nice paper which surveyed Nevada residents, and asked Nevada residents about their willingness to accept a repository if they thought that the repository was the best solution to the problem of handling nuclear waste.

And in Nevada, he found a significant increase in acceptability of a repository if the problem was posed that way. He then raised major questions as to how you conveyed that message to the public, but again it comes down to this framework kind of issue. So I'm just tossing it out. It's almost out of order in regard to the monitoring issue,

because the monitoring issue is narrowly focused on Nevada. But if we find out that the effects are going to be this big in Nevada but they'd be this big if we did something else, then that's important to know for policy makers, but I also think it's important to know for the people in Nevada.

DR. BREWER: Does anyone care to follow up on that? I think it's an interesting--Doug, why don't you talk about your own study.

DR. BASSETT: Did I summarize it right?

DR. EASTERLING: You did just fine. I think the bottom line was just that I was trying to make a point about acceptance rather than monitoring economic impacts, and trying to come back to framing the issue as an option, one of many, but I think it's fine.

DR. BREWER: Elaine. Oh, pardon me, Lee.

DR. WILKINS: Well, since we're sort of walking between topics, I think this issue of framing is really important, because if in fact you frame it as something that has to be or will be mitigated, you have changed some real key things that people think about. The closest corollary that I have is what went on in the Midwest after the '93 flood, where the federal government and FEMA and a lot of local folks got together and decided we're going to mitigate this problem. We're going to figure out a way so that people are not getting flooded out of their homes on an average of once

every five years.

The minute that framework changed, the minute instead of saying the problem is how do we fix the flood damage and you change it to how do we make it so that flood damage is less likely to happen, you open up, at least in the Midwest, a huge raft of potential solutions that weren't really considered before.

Now, it's not that those potential solutions aren't contentious; they're very contentious, you know, opening wet lands, what's the new role for the Army Corps of Engineers. You know, all of those things are politicized, they're contentious, but until you put that mitigation framework on the question, they wouldn't even have been discussed.

And mitigation has I think the real virtue of giving individual people some sense that I can have some control back over at least parts of this process, and at least in the Midwest when you ask people to uproot lock, stock and barrel, leave houses and farms that had been in their families for multiple generations, all of those sorts are very difficult psychological, emotional sorts of things. That issue of getting control back, of having some way that I can deal with it, that I can continue to make choices in this framework becomes very crucial.

So as you're thinking about framing and all that sort of stuff, I would suggest that one of the places that

you look is in the natural hazards literature, particularly that portion of the literature that talks about mitigation, and particularly the role of communities in developing mitigation strategies. That's not to say that it's a panacea or anything else, but it is a place where we at least have some hints of some things that have worked in cases that in some ways are analogous and in some ways aren't.

DR. BREWER: Be thinking; how does the Midwest experience, I mean, what are the lessons there that might be applied to Nevada. I can see your point about trying to reframe the problem in terms of systems of compensation and mitigation, but what difference does it make for Nevada? The flood case, I understand it I think, but Nevada I don't see it. It's not so clear to me how you make the leap, and that for us is really the important question.

The second issue is what if you've got something that can't be mitigated at all?

DR. WILKINS: Actually, I think the second question is easier to handle than the first one. If you've got something that can't be mitigated at all, you'd better say so and not kid folks, because they're real smart and they'll figure that out.

As to what the connections are, I think we've, you know, we've gone around and we've talked, we realize that things nuclear are in many ways unique, and there may be only

a certain level of analogy that it's appropriate to draw on. And after that, you're really on new ground, cutting edge, you know, whatever cliche you want to invent to explain it; you're in unchartered territory.

DR. PRICE: I've been trying to get in here for quite a while.

DR. BREWER: Please.

DR. PRICE: In respect to whether or not you can reasonably mitigate this issue, the monitoring is an immediate kind of a world concept. The forecasting is really basically an immediate kind of forecast. Forecasting certainly gets into difficulty if you get forecasting ten years ahead, or a hundred years ahead, really trouble, a thousand years ahead, you know, how feeble is it and how robust is it for 10,000 years and how robust is it for 100,000 years, and how can you reasonably provide mitigation and compensation for something that involves a framework of 10,000 to 100,000 to 300,000 years. That goes to this uniqueness that you're talking about.

DR. JENKINS-SMITH: We wouldn't even know who to compensate.

DR. BREWER: Warner, are you prepared to answer that question?

DR. NORTH: No, but I'm prepared to be shall we say looking for analogies rather than viewing this as a problem

of enormous difficulty with few precedents. It seems to me we might look at the other side; what are the precedents, what has been learned about how to do this.

As we look at the language in 10 CFR 960.526, it strikes me that language is not uncommon for federal agencies and state agencies, and similar things are on the books in a lot of other countries. It's not just the nuclear issue. There are lots of noxious facilities that have to go somewhere, and if a process like this is to be used to try to engage in analysis, planning and consultation among the federal entity, the affected states, local governments, Indian tribes, et cetera, where has that been done well and what can we learn from it.

I think we've skirted around that. We've certainly had issues having to do with energy development. We've had issues to do with transportation. When the freeway was proposed to go through my little town in Connecticut when I was growing up, that generated a lot of town meetings and a lot of concern over what the impact would be on the future of the community and the character of the community.

So I don't think we should say these problems are entirely new and different because there is a nuclear stigma involved and we're looking at impacts across geological time from the present. Rather, a lot of the phenomena are similar at least in some respects, and have generated similar

concerns about what these impacts really will be, and what can be done to provide the information necessary to examine issues of mitigation and compensation.

The problem I have, and I've had some experience in the energy business and so forth, is if I were asked what's the equivalent of the Tylenol situation where Johnson and Johnson did a very good job, what's the equivalent success story to point to for where this got done well, especially determining how to do the baseline monitoring and the like. I'm not sure I've got a good example, and I'd love to hear others on the panel talk about what experience they've had that would suggest we've got an analogue to Tylenol and Johnson and Johnson, where some agency did this quite well, and even though it's a different situation, it's one that we could commend to the Department of Energy for an area they could learn something from.

DR. BREWER: So let me see if I can frame the question. It's one that was in the back of my mind for this morning. What would success be in terms of a system of compensation or mitigation? Would you know it if we saw it? Or have we already seen it someplace? What would it look like; that's the question, isn't it?

DR. NORTH: Is there a case study that appears to have strong similarity to this one, particularly with respect to the baseline monitoring and forecasting aspects?

DR. BREWER: Well, there are two parts. Is there something, and we should see if there is, and then if the answer is no or we're not in agreement, what would success look like in this case for Yucca Mountain? Okay, Jim?

DR. OPALUCH: None of these are probably exactly comparable, but in the landfill siting, there have been a number of successful siting cases where communities voluntarily accepted the landfill.

In terms of the monitoring, the one lesson that I would recommend that DOE look at is the Tri County monitoring done in the Santa Barbara area for OCS Oil. I don't know a lot about it, but I know that they did a fair amount of monitoring, and it's one place you could look to see how they succeeded and how they failed and what lessons might be learned from that.

DR. BREWER: Yeah, that's a good reminder, because the county planning agency there is really as sophisticated as any in the world in terms of social and economic monitoring and effects, and it's directly connected to mitigation and compensation. Good suggestion. I'd forgotten about that.

All right, other success stories? Santa Barbara, Tri County; there's one maybe. Howard?

DR. SCHUMAN: Have there have been studies of Three Mile Island; that's different, not a repository. But it seems like an important case to know what happened.

DR. BREWER: The question was studies of Three Mile Island. Does anyone on the panel know? Yes.

DR. WILKINS: There have been studies of Three Mile Island. It's a good example of a bad example. If you want to know how not to do it, do what Met Ed did.

DR. BREWER: Well, maybe there's something to be learned from that. I mean, instead of having to create a new bad example, maybe there's some lessons to be learned from that.

DR. JENKINS-SMITH: What do you mean by that?

DR. WILKINS: In terms of risk communication of economic impact on the long-term economic viability of the company itself, in terms of the regulatory impacts, practically every impact that I'm aware of, with the exception of home values in the area and so forth and so on. It is regarded in the literature, at least of crisis communication, of a classic instance of how to do everything wrong.

DR. BREWER: Okay. Crisis communication, there's literature in this field?

DR. WILKINS: Indeed there is.

DR. BREWER: Okay, good.

DR. VAUGHAN: There's also literature from psychologists who looked at psychosocial impacts of Three Mile Island. There's a very well developed literature. Andy Baum has done a lot of the work looking at physiological changes, stress, coping issues and psychological impacts that

led to social impacts. So it might be a good case study to look at the different kinds of measures that might be used to look at some of the non-economic but social psychological impacts that Paul had referred to earlier.

DR. BREWER: Is this somewhat like the work that Harvey Brenner has long been responsible for relating the economics to social pathologies of one sort or another, health?

DR. VAUGHAN: Yes.

DR. BREWER: Okay. Other hands? Hank, did you have your hand up?

DR. JENKINS-SMITH: Yeah. I guess I'd be a little leery of using the handling of an accident as an analogy for how to go about making siting decisions. And I keep wanting to go back to the framing questions that we were onto before. When we're making a decision like this, particularly in contentious issues along these lines, it strikes me that framing the question in the right way so that people can actually have some sort of sense of what it is we're dealing with is important, and have some sort of meaningful way to work with the question.

In the case of New Mexico, we host a thing called the Waste Isolation Pilot plan, which is where the transuranic waste from the weapons program may one day be placed, and that issue has some of the thorniness of the Yucca Mountain question. We monitor that on a quarterly

basis, looking at the way that people are feeling about the risks associated with that.

And some of the work that we've done on it suggests that if you focus on it in a "receiver-site-centric" fashion, in other words should it go into the WIPP facility or not, you're asking a very different question than if you ask what should we do with this stuff. It exists, we can't wish it away, among these choice of options, which do you think is preferable, or if none of those work, what would you like. You get very different responses to those kinds of questions. And as a country when we're dealing with these problems, we're almost always receiver site centric. I mean, look at the way it's going in Nevada. It's not a question of how we manage spent nuclear fuel; it's a matter of should it go in Nevada or not, and we change the whole nature of the discussion when we do that.

I think it dramatically harms our ability to field these kinds of questions. Of course we have a complex decision making system and Congress sort of can preempt a lot of those, or the debate is held at a Congressional level and it doesn't really penetrate to the involved public. But I think that those are the kinds of things that are going to make a difference in how we gain public acceptance for any particular option that we may pursue here. I'm not sure that accidents and the way we handle accidents are going to help

us much in the acceptance question.

DR. BREWER: So it's a broader based issue or general framing.

DR. JENKINS-SMITH: That's right.

DR. BREWER: Okay. Doesn't take away from the sense of "Are there success stories?"

DR. JENKINS-SMITH: No.

DR. BREWER: And Warner's contention is that there are things to be learned. There's mitigation out there of all sorts. There's some procedural things that probably ought to be taken into account that haven't been. I think that's safe to say.

Are there general characteristics that the panel could think about in terms of Yucca Mountain and this specific facility that would make mitigation compensation work as opposed to not work, whatever that means? Paul?

DR. SLOVIC: Two points. One, there's some research by Doug and Howard Kunreuther about the acceptability of compensation in the nuclear waste arena, and that seemed to imply that if people don't believe that the facility will be basically safe, acceptably safe, whatever that means to them, then they really are very hostile towards the idea of compensation. I mean, it really seems immoral, you know, a bribe for taking something that no one else wants because it's too noxious, too risky. So you've got to get over that

hurdle first. If people really believe that fundamentally this is a dangerous or immoral type of activity, they're not going to be tolerant of any discussion of compensation.

The other point is a much narrower point. To the extent that there are concerns about, say, property value losses due to stigma in the region or in the transportation corridor, one might want to consider, you know, basic insurance programs that would guarantee that no one will lose value in their property because they are along the transport route or in some other proximity to a facility. And if the probabilities are as low as, you know, the technical assessments seem to indicate that there's going to really be any problem, and if there's this robustness and people will forget about it after it starts, you know, the trucks start rolling, then there shouldn't be that much risk to insuring that no one's going to be harmed in that way at least.

DR. BREWER: Good point. Jim?

DR. OPALUCH: I think one of the other issues in compensation is there's often found that monetary compensation is often found to be an inappropriate remedy for other types of losses, and in many cases, in kind compensation, you know, resources for resources is viewed as more acceptable. For instance, in the oil spill area, now the primary means of compensation is by restoring damaged resources or by providing other resources in exchange for

resources that were lost rather than monetary compensation.

DR. BREWER: Okay. So maybe you can get around the bribe aspect by doing something else, a different media of exchange basically to do the compensation.

DR. OPALUCH: Of course in the hazardous waste area, it's much more difficult to see how you would do that as compared to, you know, resource losses due to oil spills.

DR. BREWER: Gib?

DR. BASSETT: As a little bit of follow up to that, in the survey that Hank referred to yesterday, when we asked people what would happen to your level of support for a single underground storage site, if people who lived near a single underground nuclear waste storage site were compensated by reducing their taxes, we saw the response being it stayed the same, and it would increase. It asked if there is an increase in support under reduced taxes kind of question.

When the question is reframed, what would happen to your level of support if a national research laboratory at the storage facility was created to find ways to produce less nuclear waste in the future, would it stay the same, is no longer the largest response, increases now 44 per cent and greatly increases 20 per cent. It moves much more towards greatly increased support, and this confirms the work that Doug and Howard have done and that Jim just referred to.

I think it also gets to the question of monitoring, you know, for periods of 10,000 years, which monitoring for the purpose of doing monetary compensation seems just ridiculous, and that this is a complicated, multi-faceted kind of project and maybe the way to compensate it is to kind of go with multi-faceted compensation in a dimension that's analogous to this. It avoids the bribery kind of question and avoids the question of, you know, 400 years from now, what's going to happen, and so on.

I just have this in front of me. The other question in this, to kind of feel our way into what's going to work, what would happen to your level of support for a single underground storage site if all production of electricity from nuclear power plants was stopped.

DR. BREWER: The Swedish question.

DR. BASSETT: The Swedish solution. The responses stayed the same, and we essentially get a bell shaped curve in the range one to five, three being stay the same, increases 20 per cent, but decreases 16 per cent. So that to follow up on Judy's question from yesterday, and this is the one I was betting on because I'd heard this kind of a response, but it seems to not be nearly as powerful in terms of garnering support for the repository as taxes. Taxes do even better, the one I just read. You guys can't see the data; I can. But the one that does do the best, the one that

definitely does the best is this linkage to a national research laboratory at the storage facility, which was created to find ways to produce less nuclear power. The compensation is in the same kind of dimension as the kind of problem framing that the people see in the issue in the first place.

DR. BREWER: Doug?

DR. EASTERLING: I just want to follow up on a couple of things people have said about research. You'd asked earlier what lessons you could take from other facilities and other cases. One thing Paul alluded to, but a more specific result is that if you look at things like landfills, even hazardous waste incinerators, and you ask people their basic acceptance of how likely they would be to somehow tolerate that in their community, and then you introduce compensation, for most facilities, you see an increase in acceptance, at least reported acceptance.

The high level nuclear waste repositories are qualitatively different from all the other that you see, either no change or a decrease in acceptance. And it gets to that issue of somehow you haven't satisfied those basic requirements of putting in place a moral, safe facility. And adding compensation to the picture only calls into question credibility.

So that's one way that the repository seems to

somehow defy compensation. That's not to say that after--if by some reason the facility was built and then you had events happening and you were trying to compensate for those events, it may be that compensation is an acceptable strategy to make people whole in sort of a judicial sense. But there's a contrast in terms of the use of compensation in those ways.

The other point in terms of the comparison between a repository and other facilities, we asked people a whole set of mitigation and compensation questions about things that would improve the prospects for siting a facility, sort of like what Gib mentioned, and the ones that come out as being the most effective hypothetically tend to be almost impossible to do in the case of a repository. They are things like giving the local communities some control over the facility. How do you give people control over a facility where you're burying something and then covering it up? I mean, there really is no opportunity for that kind of control.

DR. BREWER: Interesting. Hank?

DR. JENKINS-SMITH: In related work that I've been doing with Howard Kunreuther, the focus was on what it is that causes certain mitigation or compensation measures to be acceptable. And one of the things that surprised both Howard and I was that belief in the competence of local political officials to understand what's going on and be able to take

measures that are in the interest of the local community was highly correlated with the acceptance of any of the mitigation and compensation measures.

And I think that one of the things that has been taking place, it's a very unfortunate dynamic, is trust and faith in locally elected officials in particular in the United States is amazingly low, unfortunately so. Many of the policy initiatives that we undertake in fact exacerbate that problem of course. We bypass locally elected officials typically in our site specific advisory boards for the Department of Energy and all kinds of other things.

In one almost tragic kind of thing that went on in North and South Carolina with respect to the program to return foreign spent nuclear fuels, state level officials made as one of their primary arguments for not bringing these materials back that the local officials were incompetent to handle it. And this was a claim that in fact--I mean, we're monitoring and measuring the way people, the trust that they have in these guys, and one thing that is apparent from the early returns is there was an erosion of the sense of confidence in local emergency and elected officials to handle these kinds of things.

It seems that part of any systematic program to increase acceptance is going to have to involve finding a way to assist locally elected officials, people in authority at

the local level who are responsive to those communities to be sufficiently competent and aware about what's going on to make reasoned decisions that are in the interest of those communities. I mean, what we have now is sort of a missing step in that sense of confidence that things are going to be handled well, and that's a nationwide problem.

DR. BREWER: And you're saying from the work with Howard, that that is critical in having local people accept.

DR. JENKINS-SMITH: That's correct. And it's almost across the board as one of the predictors of the acceptance of the mitigation or compensation measure.

DR. BREWER: Yes, Dennis?

DR. PRICE: A couple of years ago, Chauncy Starr addressed this group and advocated that if we would put our storage above ground on the surface, that it would be more acceptable to people because they would trust it more because it's out in the open and they can see it, and accidents can be mitigated openly, and so forth. I was wondering if you have any comment on his advocacy there?

DR. JENKINS-SMITH: Well, I think he's probably onto something. The way that we see that in most of the public data are that people would like to retain the ability to make different decisions in the future. To make a closed ended decision that forecloses future generations or, you know, future innovations, abilities to modify the program,

diminishes support. And to the extent that he was describing a public reaction to foreclosing those opportunities, he probably was right. We've seen that before. People think that we will know a lot more in the future. To the extent that they believe that, they want to retain the option to take advantage of that new learning.

In France, their deep geologic repositories are essentially built as underground laboratories so that learning can continue for a substantial period of time. And though I don't have data from France, I suspect that that option, retaining that ability, was a significant element in attaining and retaining public support for the program. And I think in that respect, I believe he was right.

DR. BREWER: Lee?

DR. WILKINS: Just to complexify it a little bit, the most recent data that I've seen out of the Midwest flood about trust in local public officials is just exactly the opposite of what you've said. The closer you get to the local, the more people say that they trusted their public officials, that they thought they served them well, and that they in fact did a good job. And so I don't think that this is necessarily uniform. It may vary from, you know, the kind of question you ask or the kind of event you're asking about. I'm quite positive, because we asked some crime questions on the same survey, that if you asked do your local officials do

a good job of taking care of crime, the answer is no, so I mean there's clearly a lot of differentiation there.

But I think that the point that we're all coming back to and one that really does need to be emphasized is that the perception of local competence and local control over this issue really is very fundamental to a whole lot of other sorts of perceptions and decisions that people will make. And I am not smart enough to be able to come up with all of the kinds of things that folks could do to give themselves back some of that sense of control, but I definitely think it's a question worth asking, and I certainly think that it is not an option that we ought to foreclose and say, well, just because it's high level nuclear waste, there's absolutely nothing that can be done about this issue. I just don't happen to be smart enough to figure out what that is.

DR. JENKINS-SMITH: It is the case that locally elected official competence is perceived very differently in different domains. With respect to police protection, fire control, flood control, I would assume, though I've never measured that, it's perceived as very high. When you get to these highly controversial technical kinds of things like nuclear waste, we've actually sort of tracked the responses that we get when we ask how competent are your locally elected officials to monitor and evaluate these things, we

get people laughing over the phone at us. And it has to do with the nature of the question, not the general attitude towards these locally elected official. This is sort of seen as outside their domain of capability.

DR. WILKINS: Well, but again the literature from natural hazards tends to suggest that that may be very true, the folks that you're talking about, but in some kinds of natural hazards, earthquakes, floods, you know, whatever, where you can have combinations of things happening, that doesn't tend to come out quite so much. It just may be the different framework that we're asking. But, I mean, I think that the central intellectual point that you and I are trying to make is fundamentally the same. Much of this rests at the local level. Whatever the board can do to help local folks shore up their own expertise and their perception of that expertise is going to be enormously helpful, regardless of what decision making path you ought to take.

DR. BREWER: Good observation. Yes, Elaine?

DR. VAUGHAN: One way to pull a lot of the comments together that have been made is to think about process as well as outcome. We've been talking about the outcome of compensation mitigation, but people also have to perceive that the process is equitable, fair and just, and some of the dimensions of procedural justice include perceived competence of officials, participating in discussions, openness in the

process and mutual respect for different points of view, early input.

And so I think also when we look at compensation mitigation, perhaps as important, if not more sometimes, is the actual dollar amount of the number of parks or resources that might be exchanged, also has to be procedural justice and equity issues as well.

Across communities, I hope that these kinds of approaches also consider the heterogeneity of the population, and that all communities will perceive of these processes and the outcomes as being just and equitable.

DR. BREWER: A consistent theme from you over the last two days. It's a good theme, too. Yes.

DR. BASSETT: Just to come back to Warner's, you know, why is this problem different than any other problem, there's something here. We haven't been able to point to any comparable so-called success stories, that as we get the most analogous situation we can find, it's low level waste and it seems it's difficult to resolve issues as high level waste. We can get to landfills where solutions somehow have existed, but there is this gap and, you know, it's another reason I think we're here, that we don't have a good analogy that we can grab onto to kind of guide us into how we should manage our way through this mess.

DR. BREWER: Warner, would you moderate your initial

assertions that there are examples that we can just use? How do you respond to his point?

DR. BASSETT: Warner was just asking us.

DR. NORTH: Yeah, I was urging that we try to find examples from which we can learn where some modest success has been achieved. And I think we've had a good discussion of that in the last few minutes.

I won't dispute your contention. I don't think we have had anywhere in the world yet a successful program to deal with nuclear waste at a high level. There are a number of successful installations of low and intermediate waste that we have seen in Europe which seem to be working very well and with very low levels of controversy.

It may be that we will have some success somewhere with the low level waste program in the next five to ten years, but I think the dimensions we're talking about in terms of how do you do the monitoring, how do you do the forecasting, how do you look at the impact within the local area on such things as tourism, surely these are not totally unique problems in human history. I think of the problem of siting a prison as being sort of a classic example where I think you could go back probably 50 to 100 years and look at the debates of some people want the job and some people don't want obnoxious characters that might escape and get into their neighborhood.

DR. VAUGHAN: Warner, if you look at prisons, where they usually end up is in communities where people didn't have enough political power to stop them. I mean, as you look at this over and over again, they may be interesting failure, in a sense, examples or how social and political processes play out in siting undesirable facilities.

DR. NORTH: Well, I think again it may be good to look for which states or other entities did it reasonably well as opposed to a pattern which has many, many examples of, shall we say, imposed solutions as opposed to community participation where compensation and mitigation worked.

DR. BREWER: Doug, did you want to follow up?

DR. EASTERLING: Just on this prison example. I think the cases where it's worked well, you'll probably find three or four in Colorado where communities competed to get a prison just because it's an economic development opportunity. It was framed differently. It's not framed as a hazard.

DR. BREWER: It's not framed as a bad; it's framed as a good, or the beneficial part.

DR. JENKINS-SMITH: Or at least multi-dimensional, things that people are competing for as well as avoiding.

DR. OPALUCH: There are also some examples of landfill siting where communities competed for the landfill and also compensation at the same time. So there are some lessons that aren't exactly comparable, but at least there are

lessons to be learned.

DR. BREWER: We noticed, because we were invited to attend public hearings in Sweden, there are two communities in Sweden that are actually considering to be the repository sites for the Swedish nuclear program, and it was the economic benefit. The framing of the question was much different than what we typically see.

Warner?

DR. NORTH: I need to give my two minute speech because I was not successful in my confirmed space on the later flight, so I'm going to have to leave very shortly.

DR. BREWER: All right, for the benefit of the audience, procedurally I was going to try to stop the conversation right here, going to invite several members of the audience who are qualified, interested social scientists to pose questions directly to the panel for about 10 or 15 minutes. Then we will take a break, because we forgot to put a break in here and I'm drinking water, you're drinking coffee, and we need that at 10:00, a 15 minute break at 10 o'clock, and then we'll come back for the public commentary at 10:15, and then we'll resume what we were doing.

Now, I've asked each of the panel members in the closing comments part of the agenda to provide three or four minutes, a couple of minutes, of one of the major lessons learned from today's discussion and yesterday's discussion,

the take-homes for the board, the take-homes for DOE, just generally what is it that we've learned in the last two days. And since Warner has got to go, he is going to preempt, and he's sort of out of line--you're out of line, North, as usual. Please, go ahead.

DR. NORTH: Well, great pleasure to be back here as a former member of the board to see old colleagues again and have the opportunity to participate in this forum.

I think the specific material we've covered here in the last two days is extremely valuable. I think this is an area that needs a great deal more consideration by the Department of Energy and by TRB as the oversight board, so I hope this is the first of a regular series of meetings on this topic, and perhaps a session that will encourage a much more serious investigation by the Department of Energy than what's gone on in the past.

It seems to me that this area is one that is especially deserving of dialogue with the public, especially in Nevada, to try to come to some better understanding of the different points of view on these issues, and what was reasonable to accomplish in this meeting was a start in that process, certainly not anything that could be considered definitive or dispositive. We're not going to come up with an answer.

The question of the methodology, the social science

approach are quite complicated. In some respects, it's almost unchartered territory. In other respects, maybe we can find some examples we can learn from. So I'd like to congratulate everybody involved. I'm delighted I was able to be here and wish everybody success for continuing on, including today.

I'm sorry I have to leave, but United wasn't very cooperative in giving me a seat on the later flight. Thank you.

DR. BREWER: Warner, thank you very much. Thanks for attending and for adding extra dimension, as always.

What I would like to do now is to invite members of the audience to not make public comment in the sense that we had it yesterday, but if you have very specific questions related to the discussion yesterday, or today, probably more to the point, for individual members of the panel, to please come forward and ask the questions. We'll do this for about the next five or ten minutes, specific questions related to the conversation. And then we will take a break, and then there will be the regular time for those who have signed up for public comment beginning, according to our schedule, at 10:15.

MR. MC GOWAN: My name is Tom McGowan. I'd like to thank personally Dr. Warner for attending and hope to see him again in the near future.

My comment is directed individually to the entire board, and it's actually an observation with an inherent question. There appears to be a general sense of counterpoised counterparts with regard to the issue of compensation benefits/whatever else goes with it. I would suggest that it's fundamentally flawed, and that means the entire issue, that aspect in fundamentally flawed. Nothing personal.

We are not two separate and distinct autonomies. We are a society. If we are not a society, we are an anarchy of one aspect or the other. The secret to this whole process is togetherness, and the minute we get together, we'll begin to move forward an inch or two. Until that time, we continue to disintegralize into separate and respectably opposing regimes. You don't want that, do you, regarding local response to emergency disaster of any kind.

It's not a question of whether people trust local entities. Quite frankly, if you look at their books, they are neither enabled or resourced to respond to any additional egregious events, particularly in this neighborhood, in a timely manner. But the law states first on the scene is responsible, accountable and viable. DOE gets a phone call maybe by three or four down the line, something like telling a joke, eventually it comes out wrong.

I respectfully request and recommend that DOE take

a responsible position from the outside, including carrier, and that's a question. Thank you.

DR. BREWER: Does anyone on the panel care to respond? This is not the public comment session. There was a request from the audience to ask direct questions of our panelists, feeling that there were some technical things that needed to be cleared up. We will have public comment if you have signed up for it later. If you have a question for the panel, Steve, please ask the question. But identify yourself.

MR. FRISHMAN: I'm Steve Frishman with the State of Nevada. I will have some comments later. I do have a question, though, that has threaded through all of the discussion yesterday and today, and that is there seems to be an underlying thread in here of there is a problem and there's got to be a solution. Now, I'd like to hear what the panel thinks the problem is and what they think the solution is. From my perspective, the only problem that we have is that Nevada refuses to accept the repository, and the only solution is we will accept it. Now, is there any other problem and solution that's on the table here?

DR. BREWER: Anyone care to pick up on that one? Yes, Hank?

DR. JENKINS-SMITH: I like the way you posed it. That's one of the reasons that I think framing the question is so

important, gets exactly at this point, and I think the problem is a societal-wide problem of how we manage nuclear waste, and that the reason I object to focusing on specific sites and analyzing them in terms of impacts on specific sites is because that tends to particularize the question, raise the sorts of animosities that we have in New Mexico or here in Nevada, and perhaps we should be thinking about it more in terms of what are our alternatives with this, what are the most reasonable ways to go about it, and engage in a dialogue of that kind. And I think that by reframing, I mean asking different kinds of questions.

MR. FRISHMAN: Well, you know, I appreciate the conversation that's been going here and in my career for the last about 15 years, I had to deal with the same kinds of questions in Texas and the same ones that we're seeing here. They just dealt with sort of different things. In Texas, it was agriculture, but we still had the same problems.

But to get to your answer, we here today are dealing with reality. The reality is that I think I posed the question correctly, and I posed the only solution correctly. I think it's nice to think about the rest, but for today's purposes, the real value that would come out of the discussions that went in the last few days is if you guys somehow came up with that magic bullet that DOE is looking for.

Other than that, I think maybe we're in the wrong forum to be discussing these very important matters, because you are making real progress I think in trying to analyze and help people and societies react to the types of problems that you're talking about, and it would be really nice to be able to apply them in a fair and honest situation. But we just don't have that. So I would like you to be, you know, thinking pretty hard about what the record of your conversation here means to somebody other than you and your colleagues.

DR. BREWER: Okay, thanks. Paul, would you like to respond?

DR. SLOVIC: I think that a lot of the discussion has implicitly supported the notion that we do not yet know how to manage this problem of dealing with high level nuclear waste as a society, that we don't have the full understanding of the impacts and how to deal with the conflicts in a democracy such as we have. This hazard poses challenges of an unprecedented nature. And some of us have gone on record in writing that because we don't know how to manage this, we ou ught to back off and, you know, it may take decades or more before we figure out how really to make these kind of decisions. So, you know, in that sense, it calls for, again, backing off, slowing down, not rushing to some sort of irreversible decision, and taking new looks and, you know, a

much different pace, much different perspective on the whole problem, admitting that we don't know how to do it. I think that's in support of your notion about there not being any solution at this point.

MR. FRISHMAN: Thank you. I was hoping that that would become part of the record of the discussion, and I would appreciate it if that were somehow indicated to be the feeling of the panel, because otherwise I think some of what has been discussed may be misinterpreted by those who would use it best.

DR. BREWER: Thank you, Steve. Anyone else in the audience have a technical question for members of the panel? Jane? Please identify yourself and your organization.

MS. SUMMERSON: Jane Summerson; I work for the Department of Energy, but I want to step back from my DOE days and back from my geology training to the days when I was a graduate student in social sciences and follow up on a question that Dr. Cantlon had asked.

In talking about baseline monitoring here and looking at changes in slope and correlating them with the potential building of a repository, I was trying to think of an analogy, and this might not work schedule-wise, but if one looked at economic indicators in Denver over the last 10 or 15 years, I think you'd see tremendous crashing of property values, business problems, that kind of thing.

During that same time period, we've also had a lot of information come out about Rocky Flats. You might be able to get a correlation there. If you didn't take into account what happened to the petroleum exploration industry, you might draw a very, very incorrect conclusion, and as a new resident here in Las Vegas, I'm real worried about our water resources. If we're not looking at the other variables that affect these things and document those, we could really be in trouble here. And I haven't heard any talk when we were talking about this baseline monitoring about monitoring and really identifying what other societal variables could control these same issues.

DR. BREWER: Thank you. Response?

DR. JENKINS-SMITH: That's what I was trying to convey when I was saying that there are a lot of things at play, and that we can't really have a control. And one thing that has been raised is that there are many places, including my own state now, that have casinos proliferating all over the place, and we can't just assume that whatever changes occur, occur because of the disturbance or because of the creation of a repository. And knowing how to take into account all of the other factors that might be in fact leading to those changes is a difficult problem, particularly as we get into less directly measurable economic kinds of variables.

I've known of cases in which people have attempted

to monitor, say, public health, and they've measured change over time and the frequency with which people are seeking mental health counseling in public agencies, and find changes that one could hypothesize were due as much to changing the jurisdictions in which that mental health area, the number of people that were in their jurisdiction, as much as any change that was going on in those communities that were affected.

I mean controlling for all of the other factors is an extremely thorny problem, particularly when we get out of areas that we know we've modeled well. And that's why I think we're more on the frontier of understanding that than we are in a well plumbed area that we can nicely specify those changes.

MS. SUMMERSON: It also seems to me that when you take into consideration one of the things we're talking about as being a negative is the slowing of the growth, but again as having moved here, the rate of this growth, we're looking at our kids going on double session school at all ages, maybe the slowing of that growth isn't a bad idea, and I like living here. I want to keep living here.

DR. JENKINS-SMITH: Well, I was thinking about that. For many residents of the state of Nevada, probably the optimal thing would be to have everybody think there was a repository, which would slow the growth, but not really have one.

DR. BREWER: Okay.

MR. MC GOWAN: Could I please have an answer to one of my two questions?

DR. BREWER: During the public comments, Mr. McGowan, I think we can come back to your questions, if you would like to sign up. Okay, thank you.

Identify yourself, please.

MR. LA PORTE: I'm Todd La Porte, the Department of Political Science, University of California at Berkeley. I have two questions that are of a more technical nature than the last two.

To what degree, or would you comment on the degree to which you can or you've seen taken into account the shaping of political institutions as part of the social impact analysis that's being done. The comment there that the kinds of things we've been hearing with regard to the demands levied on public institutions regionally and locally as a consequence of some of the things you've been talking about seem to be rather extraordinary, and in terms of the monitoring of those kinds of changes as an important bit of data.

Secondly, could you comment, I'd like the comment of the panel on the costs of mounting the sorts of research programs that you've been implying through this, particularly Steve Kraus's rather nice summary, of the kind of

obligations, intellectual obligations that flow from trying to be rigorous in the kind of monitoring process you were talking about. It suggests that there's a lot more work to be done and a lot higher costs to be incurred to do this well.

DR. BREWER: Interesting question. Lee, do you want to take a whack?

DR. WILKINS: I can take a crack at the first one. Some of what you're suggesting has been done in a case study format, and probably one of the best researched of those are the number of books that have been written about the Bhopal disaster in 1984, which resulted in changes in the way that the chemical industry does business, resulted in legislative changes, particularly SERA, particularly SERA Title 3, which is the public right to know act, the first one that has been adopted, and has certainly resulted because of SERA in a lot of development by local political entities of evacuation plans and routing plans and, you know, all of that sort of stuff.

So at least in terms of that one particular case study, that one has been looked at by a number of people in different fields fairly extensively, and the changes that took place all the way from national legislation down to the way local entities acted has been examined and looked at. So that is one place where you can see the ripples in the pond

of this sort of thing having a lot of effect on systems and institutions at different levels of government, as well as in business and industry.

DR. BREWER: Would somebody care to pick up on the cost question? Steve, you were invited.

DR. KRAUS: You're right, in that the kind of monitoring study that I talked about that really kind of, you know, combined looked at behavioral data, economic data with, you know, a monitoring of attitudes and risk perceptions over, you know, a fairly long period of time on a fairly regular basis, you know, could get to be somewhat expensive, particularly given that the statistics that will be involved in trying to discern some kind of causality out of that very complex set of data, you know, would be fairly sophisticated.

The government does that kind of work right now, maybe not in this particular area, but in other areas. The government does a fair amount of out sourcing of research to private research firms like the kind that I work for. There are also a lot of research personnel within the government whose full-time job it is to carry out research like that.

If I were asked ballpark what the cost might be, I mean, it could easily run to half a million or a million dollars a year to run a study like that, even on a quarterly basis and fully analyze the data to find out, or to at least leverage some kind of causal conclusions about what's going

on there.

On the one hand, that's expensive, and on the one hand, you know, we'd all like to reduce the deficit and the debt. On the other hand, when we look at places to cut money in terms of government spending, I'm not sure this is the place that we'd want to do it. You know, this is the place to really think about the research, put a lot of thought into what it's going to be like, what questions it's going to address, and to get it right. I think the implications of getting it wrong outweigh the costs.

DR. BREWER: Jim, and then Paul.

DR. OPALUCH: The figure that I had heard for the cost of digging a hole is like $400 million a year. You know, you put it on that basis and you're not even talking about the measurement error, you know, that's half a million to a million dollars a year isn't even measurement error.

DR. BREWER: Paul?

DR. SLOVIC: A similar point. We're talking about an effort that is running into the tens of billions of dollars in terms of finding a site for high level nuclear waste or finding some way of dealing with it. The amount of money that's spent so far on this kind of social science issues that we've been discussing is sort of trivial in comparison by any standards.

I mean, there's really been some few millions of

dollars spent on social research. That's why we lack a lot of the answers to the questions that are being raised, not that more money will necessarily pave the way to solutions, but most of the effort in this hazard management domain and many others goes into the technical side of risk assessment to try to learn more about the technical aspects of risk. And we spend a lot of money on, you know, geology and other technical areas which, you know, that's fine, but we tend to neglect the social and management side of it.

The ratio of amount of money spent on the technical side of risk assessment to the amount spent on learning how to manage the problem from a social standpoint, it may be, you know, 1,000, 10,000 or more to one in terms of a ratio. And as you see, these are tough problems that we're dealing with, and you can't do this on a, you know, solve them on a shoestring. And, really, the amounts of money we're talking about for this type of effort, relatively speaking, are trivial.

DR. BREWER: John? John Cantlon?

DR. CANTLON: Yes, John Cantlon, Board.

I'd like to get you to follow up, or some of the other members of the panel, on the distinction between what DOE is funding with DOE's budget versus what the affected counties and the state is funding in this area. Do we have some kind of measure of that difference?

DR. BREWER: Rough ideas? Hank, some idea?

DR. JENKINS-SMITH: I don't know what the overall coordinated effort on the part of the Department of Energy has been. I mean, I know that the budget that we've received over a fair number of years has been something less-- something around $300,000 I guess total. There are people who can answer that question.

DR. BREWER: I think this might be one of those people. Would you identify yourself, please?

MR. SALTZMAN: I'm Jerry Saltzman with the Department of Energy. I don't know how much is spent on standard effects here in Nevada, but we have been supporting perceived risk work out of Washington at a level of about $200,000 a year for the last couple of years.

DR. BREWER: Thank you, Jerry. So there's the answer to the question. Thank you very much.

DR. JENKINS-SMITH: What about the Nevada side?

DR. BREWER: The Nevada side? Anyone? Please identify yourself for the record.

MR. STROLIN: I'm Joe Strolin. I work for the State Nuclear Waste Office. We've been supporting the research at about $300,000 a year. The research has gone on actually since 1986, and at one time was funded at considerably higher levels. Much of the research that's been talked about by Paul and by Doug was conducted at the time when we actually

had some real money. At this point, we're basically able to fund small studies, $50,000, $60,000 studies here and there. $300,000 doesn't go very far. It's a very insignificant amount of money.

DR. BREWER: Thank you very much.

Let me take the chair's prerogative and draw to a conclusion this part of the panel. I thought our departure from schedule here, which we can do, by having additional questions from the floor was good.

I have five minutes after 10:00. Let's reconvene at 10:20 for public comment, 10:20.

(Whereupon, a recess was taken.)

DR. BREWER: Let's see if we can find our panel.

We're starting up again, everyone. We have allocated 30 minutes for public comment, and we have a number of people who have signed up. I'll take them in the order that they have signed up. Please hold your comments to between three and four minutes so that everyone has an equal chance.

Sally Devlin? Sally? We'll come back to Sally. Is she outside? Steve Frishman is next on the list. And, again, we know who you are, but would you for the record identify yourself?

MR. FRISHMAN: Steve Frishman, State of Nevada.

Now that I've got the hard question out of the way,

I have some other things to say. Garry, at the beginning you said that the board doesn't have a position on whether risk based or perception based risk impacts should be included in the site suitability determination. We just heard that the Department just in the last couple years is spending approximately two-thirds of what the State of Nevada has spent each year over a number of years on perception of risk.

This is an area where the Department staunchly refused to even give credence to the need to begin looking at it for all of the years up until just a couple years ago. I experienced it rather severely in Texas when we were trying to look at the impacts of a nuclear waste repository on agricultural production that is marketed all over the world, and we found some rather astonishing things just empirically. The Department still had no interest in it, partly because it's difficult to deal with, and I think these last couple days have maybe amplified for some of us how difficult it is to deal with now that people are actually trying to deal with it.

I guess what I would like to ask, just to sort of help the board along in its work, is if the panel would be willing to tell the board its views on whether risk perception is in fact a legitimate element in considering site suitability for Yucca Mountain, so we can actually have on the record to the board something that is very important

in some near term decisions that are coming up, and we also already know pretty much where the Department is on that decision, and I think it's a fatal error if they can find excuses rather than reasons for ignoring it.

And if there are reasons, I think let's get them on the table. I personally don't believe there are any, but I'd appreciate it if the panel could speak directly to that to the board so that we have a pretty clear record of suggestion, recommendation or at least opinion.

Thanks.

DR. BREWER: Okay. Let me repeat, as Steve sort of gave me the entre, the Nuclear Waste Technical Review Board has not taken a position. I acknowledged in the opening comments that the 1983 Payne v. U. S. decision with respect to NEPA said the risk based perceptual studies were not relevant to the EIS process, but went on to say that according to DOE's own regs 1984, 10 CFR 960, the requirement to at least consider the issue was on the record.

And so the determination of site suitability at some point may or may not include risk, and I will repeat for the record the board has not taken a stand.

Second point, the panel has been asked to explore a range of very, very complex issues. That was also part of the overall commentary. Nothing from the panel was expected in terms of having a vote or being definitive on the given

issue, but I am perfectly willing to open to the panel as individuals, again speaking as individuals, that was the basic ground rule to get them here, if they choose to comment on the question or the invitation from Steve. Let's leave it at that.

Is there anyone on the panel who would like to respond? Yes, Paul?

DR. SLOVIC: Well, I think that the premise of a lot of the research that my colleagues and I have been doing over quite a long period of time is that risk perception has impacts. It has important social, political, economic impacts. It may be that certain rulings in the past have denied the relevance of these impacts to environmental impact statements and the like. I don't think that that's the last word on this issue.

There's been a lot of development in 10 or 15 years in our understanding of the ways in which perceptions affect individuals and society. We've been airing what we know and what we don't know about that during this meeting, and I think that any agency in charge of this process would be remiss not to consider this as a legitimate impact.

DR. BREWER: Thanks, Paul. Anyone else? Yes, Elaine?

DR. VAUGHAN: Also, I think we can think of many examples where managing risk in society has been so difficult and often agencies, like the DOE, should look to its own

history I think for the best reason to include risk perceptions and the kinds of issues we've been talking about here and why it's important.

A lot of conflict in society about these kinds of issues has arisen because I think many agencies use too narrow a model in the framing of the problem, and these issues will be important whether the DOE chooses to formally incorporate them into considerations and approaches or not.

I think they are important. They have manifested themselves, and if we don't pay attention to them in a formal way, or at least start to create processes that include these, then people will manifest the effects of risk perceptions in other ways, and we've seen that over and over again. In some instances, communities and individuals have made it impossible for the implementation of policies. There is a reason why the new siting of nuclear power plants has not occurred since the late Seventies.

There's a reason why we're here today and the DOE and other agencies are groping for ways to minimize conflict and to reach better decisions. So they are important. I think the question is how do we include these, and I think perhaps the best way and most efficient would be in a formal way, formal consideration.

DR. BREWER: Thanks, Elaine. Hank and then Jim.

DR. JENKINS-SMITH: I guess I have to separate the

question into two parts. As a social scientist the question that drives me is are there impacts, how would we characterize them, what sort of, you know, how reliable are our measures, and things along those lines. And empirically, the evidence suggests that these things might occur. We still have a long way to go in order to clarify exactly what is happening.

I think that there are also some sort of policy science questions associated with how we think about them. Should we be thinking about net impacts? Do we always have to compare to some sort of base decision when we're thinking about these net costs?

But I separate those kinds of questions from whether or not they ought to be included in a decision making process, and we as a society, we continually evolve in terms of what kinds of things should formally be included in a decision making process, and these things come from institutions that we have as a society. I mean, we changed our minds a lot when we created EISs to begin with as a formal process of how to make social decisions, and that really goes beyond anything that--I mean, you then get into personal evaluative judgments about how things should be done. I think that's sort of beyond the scope of what I understood we were here to do as a panel.

DR. BREWER: Clearly. Jim?

DR. OPALUCH: I think there's a lot of relationships between risk perceptions and impacts. I think risk perceptions are indicators that impacts have occurred. I think risk perceptions lead to other kinds of impacts, whether, you know, people leaving the community or tourists not coming to a community, or something like that. And I think from the larger perspective, the risk perceptions have led to effectively shutting down the process in many cases of siting facilities, that it's led to dramatic, very high costs to the larger nation in the costs of trying to site something, the opportunity costs of not having the facility that they desire to have sited eventually, and also in terms of people's feelings about the government. You know, people feel alienated, they feel angry, and there's all kinds of impacts that result from the risk perceptions and from the way the government deals or does not deal with people's concerns and perceptions of risk.

DR. BREWER: Anyone else on the panel care to respond? Yes, Lee?

DR. WILKINS: I think in some ways what you're seeing up here, excluding the fact that we can all be apologists for our own research agenda, is sort of the societal realization that this is more than a technical question. We have a long history of trying to deal with issues like this as if they were purely technical questions, and then running aground on

the fact that our analytic framework was not wide enough to incorporate the other issues that arose naturally from that.

So at that level, I think how I would respond is I would like for the board to tell the Department of Energy that this is important and that dealing with it, even at what to some of us is this relatively late date, is probably less costly to the state of Nevada and to the nation as a whole than going strictly by the legal precedent and the statutes as they're currently drawn.

DR. PRICE: Garry?

DR. BREWER: Yes, Dennis Price.

DR. PRICE: It could very well be important. The thing that bothers me is is it tractable, and in listening, the variables involved and just what you were saying, getting it wide and broad enough to cover, I just jotted down some things, world situation, war, peace, economics in the world, national economic health, tourism, water resources, proliferation of gambling in other states, disease control, law and order, retirement growth, population influx from California, transportation corridors effects, airline industry health, status of DOE, trusts of government, stigma, social amplification, imagery, intentions, feelings of happiness and anger. There's so many variables that you've got such a mosaic that it's very easy to be very, very skeptical, and I'm wondering from the panel what is the hope

that it is tractable.

DR. BREWER: First of all, welcome to the world of social science. Doug?

DR. EASTERLING: I guess my first question is is that list any bigger than what the hydrologists deal with?

DR. DOMENICO: Given a lot of variables, we can fit any curve.

DR. BREWER: Thank you, Pat Domenico. Almost a benediction for this meeting. That's wonderful. Yes, Hank?

DR. JENKINS-SMITH: I guess the question is an important one, and it cuts to the question of how you organize any sort of scientific enterprise to study a problem. Now, we have ample evidence of the difficulty of doing this by looking at the application of the physical sciences to Yucca Mountain, to WIPP, to any other program.

It's been tough to organize a process by which science is sensibly used, and let me just name some of the types of charges that have been mounted, some of them grossly unfair, at the scientific enterprises that have taken place to date. I mean, there is enormous uncertainty associated with any geophysical activity when you go into a site and you try to characterize it. At WIPP, there are all kinds of things that have been learned and revolutions in the way that the problem has been conceptualized associated with gas generation and potential for explosion and fracturing and

fissuring and things like that. And these kinds of things turn into additional--they spawn research projects.

I've heard people say that what happens is that the scientists who get involved in these projects have a self interest in generating science and, therefore, they magnify, in essence, or perhaps just exploit the uncertainty that's inherent in their area in order to further science. I've heard people characterize this as the scientific sand box surrounding Yucca Mountain and WIPP.

Now, what this is is it's a question of how you manage science, how you actually employ science to look at what are relevant kinds of questions. I would hate to see this enterprise turn into something like that. That's why I have some real ambivalence up here thinking about how should I frame a research project here. There's a morass to be avoided somehow in thinking about what are the most important problems to be getting into, what are significant. That's why from my standpoint, in order to try to be able to look at myself in the morning when I get up and think about doing this research, is to try to identify what I think are the most salient questions to ask before getting on to other ones.

There has to be some way of prioritizing what we think we look at without at the same time cutting off what would be important research questions to get into. It's a

type one, type two error problem here. We can look at the kinds of hypotheses we have from existing theories to try to confirm or dis-confirm them, but we also have to keep broad enough scope to make sure we're not missing critical issues that need to be addressed.

You know, this is quite frankly, I'll confess, this is beyond me. I don't know how to structure a scientific enterprise in a specific case like this. It's very difficult. Somehow we as a society stumble along, however, we do make choices. The question is how do we do this without turning it into a blooming buzzing confusion of scientific work.

DR. BREWER: Paul, and then we'll get back to the public lineup here.

DR. SLOVIC: I guess your comment speaks obviously to the difficulty of doing all this. This refers to what Hank, or the distinction Hank made earlier between difficulty and legitimacy, and truly it is a difficult task, but I think the issue really is are these legitimate questions to be asking. And if the answer to that is yes and the answer to the subsequent question is well, what are the answers, is that we don't know, is that not a meaningful part of the situation when we think about how to manage this whole process of dealing with radioactive wastes, you know, and is it not relevant to the need maybe to take more time in figuring out

how to go about making this decision or what to do about the whole not only the waste enterprise, but the whole nuclear energy enterprise.

So I would say that the first point of focus should be the evaluation of the legitimacy of the kind of impacts that we're talking about today.

DR. BREWER: Okay, good. Thank you very much.

Let's get back to schedule. I see Sally Devlin is here for public comment. Would you please hold your comments to about three to four minutes, and also identify yourself, please?

MS. DEVLIN: Thank you. I'm Sally Devlin and I'm from Pahrump, Nevada. That's Nye County. That is where the test site is; that is where Yucca Mountain is, and I haven't heard one word from anybody except Clark County. But before my time starts, I want everybody to know that John got his jokes and, no, DOD did not call me and tell me what they're going to do with their 10 per cent. This is left over from the last meeting.

All right, the reason that I wanted to make a comment was I am very verbose and contentious, and I have seen little humor. I just took the sociology course at the college and I know what you guys do, and so I thought you needed a little humor and I will supply it.

Now, I'm going to do two terrible scenarios and end

up with my question, and these are the worst scenarios. You hear all this vocabulary John and the board have taught me. This is the worst scenario because this is something that could happen, and that is it's about 4 o'clock in the afternoon on Highway 95 and everybody has had their ten hour shift, or going to have their ten hour shift at the test site or at Yucca Mountain, and so there are about 4,000 cars on U. S. 95 and they're going by the prison at Clear Creek with about 2,300 hard core murderers and 1,600 guards and a small Air Force base, so there are about 2,300 people and 4,000 going back and forth, and there's a happy little diesel truck, a double diesel truck. We sometimes allow three of these trucks because our highways are so well built, unlike California. And all of a sudden, the diesel truck catches on fire, and along with the fire, is the tremendous Nevada winds about 40 to 70 miles an hour.

And so all these people in their cars, all these people in the prison, all the guards, all the Air Force, everybody is on fire and there aren't any fire engines. The closest place is about 38 miles, which is the test site. It's about 60-something miles from Pahrump and we have cooperative agreements with Clark County because it is in Clark County, so our firemen, our EMT, all 58 firemen, and our fire department just lowered their standards because we can't get anybody to work at the fire department because our

town is the oldest population in Nevada. We have 64 or 67 per cent over 55 in very low income brackets, like me, and therefore, nobody could afford to serve on the fire department.

We've had no FEMA training. Of the 58, only six are first class. So, you see, we have a bit of a problem. All the EMTs, and we had over 1,200 calls this year, and I don't know how many flight for life, but it was enormous, something over 500, so you're seeing, being 70 miles from Las Vegas, over a mountain and so on, we do have real problems.

But anyway, our little fire department goes out and runs up to this terrible fire. In the meantime on Mountain Springs, which is 6,000, give or take, feet, they have a little fire department with absolutely no training, and Clark County says my God, the Metro is going to close the highway for five miles in either direction. The Highway Patrol, by law in Nevada, must control an incident. The sheriff can do it until the Highway Patrol gets there. And for all of southern Nye County, they only have six highway patrolmen, which means two are on duty for 2 million square miles at any one time, and Clark County, maybe they have 14 highway patrolmen, and they have to do it from the other side of the highway.

So all this fun is going on. The Nellis Air Force Base is flying people over, the test site is running people

down that have had FEMA training, all kinds of good stuff. And so it's a very big mess, and then of course Clark County on the other side, because 160 that goes through Pahrump parallels 95, is sending a truck that has yet to make it over the hill to help, or around these 60 miles to get to this mess.

But in the meantime, my friends, we have another situation, and that is on Las Vegas Boulevard, there's an earthquake and the Offices of Defense has an evacuation plan. And what that evacuation plan is is the west side of Las Vegas Boulevard, all half a million people, are to go over the hill to Pahrump with two weeks food and water, and follow the fire engines over the hill and go to our one concrete building, which happens to be the high school which houses 800 students, and the other half is to go down to Overton, again with two weeks food and water, and join the Mormons with their two years food and water that's hidden in the ground. And that is the situation.

Now, you're getting a picture and you know what my question is. Is Pahrump expendable? And I've heard this from three different people. I did the demographics. We are today, and I'll throw in Amargosa, I'll throw in Johnnie, I'll throw in Crystal and I'll throw in Beatty, and we've got maybe 23,000 people, but in all their wisdom, the county commissioners have allotted 48,000 parcels in our town.

Remember it was formed as a land scheme.

So what happens? You're going to ruin our water. We're getting strontium 90. Remember when all the mess was done at the test site, Pahrump wasn't even born until 1956. We didn't have a road to Las Vegas until 1964. We didn't get our REA rural electrification until about that time. So in the meantime, Nye County gets no benefit whatsoever from either Yucca Mountain or the test site. We've got a few PETA funds in lieu of taxes, and that's it.

As a matter of fact, we're in litigation with Nevada Power because our REA, Valley Electric, was supposed to get the contract for the test site and didn't. So they're in litigation. We have not benefitted. We can be poisoned. We have a very serious situation that nobody talks about because all you hear is a hundred miles from Las Vegas.

Now, Nye County is going to take the brunt of it, and I think you have an obligation as sociologists to look into this situation.

DR. BREWER: Thank you very much, Sally.

MS. DEVLIN: And so you've got a funny picture. I just want to say one other thing. We were talking about hydrology, right, Dennis? And I read a hydrological report where they're still looking for where the aquifer meets the carbonate, our aquifer meets the carbonate from Amargosa, which goes down to Death Valley, which is also never talked

about, which is just 55 miles from Yucca Mountain as the crow flies.

But anyway, one of the funny things is I said, "Where are you having all these problems?" And he said, "Lathrop Wells." And I said, "Under the brothel and the bar?" And that's the end of the railroad, under the brothel and the bar. So you see why we are Nevadans; we're free, we love this beautiful big country, we have no law whatsoever in Nye County. We have no protection. We have nothing, but we can laugh.

DR. BREWER: Thank you very much. The next member of the public is Mr. Williams, Jim Williams. Try to limit your comments to three or four minutes, please.

MR. WILLIAMS: I'm Jim Williams, and I'm with Planning Information Corporation and we've done work with the state and a number of the affected counties, socioeconomic programs over the last few years, and my observations, however, have to do with--are my own and reflect my own confusions about this. And they start with focus on the guideline that was promulgated in 1984, and my reading of it, and it's been shown here several times, is that it focuses on a repository for permanent disposal, separate from centralized storage and from transportation And permanent disposal in the House Budget Resolution is going to be zeroed out in a couple of years, and under the Senate Bill 167, will be third in

priority to transportation and interim disposal.

It also focuses on the location of the site, not the siting process, not the management and financing of the siting process, not the perceptions of the materials involved in the siting process. It was also done in 1984 before most of the research that has been discussed here was even conceived, I think, or done.

I think you could make an argument, I would make the argument that it would be in DOE's advantage to deal with these issues directly, because if they do not, issues of equity, management, process, perception all get filtered into the process in other avenues and in many cases, less appropriately. But these are DOE's guidelines. I don't see them changing them at this point in time. They don't want to change their rules of their game.

The guidelines also assumed that adverse social and economic impacts are initiated by project employment, procurement, maybe the shipment of materials and supplies. It did not conceive of impacts, social and economic, initiated by equity, perception, management and finance, or by things other than the repository site itself, like centralized storage and so forth.

The act itself in 1982 considered and addressed some issues of equity at the state and national level, but in these 15 years, those sensitivities have been removed from

the program.

So it's common place in the hard sense community that the problems in this program are not with hard sense, but with equity, perception, management and finance, all of which are co-related, as you all have well discussed, among themselves and with baseline conditions. It's very hard to measure precisely, to reduce to a technical criteria about which impacts can be precisely attributed. But it at least is probable and is present and is apparent as many of the hard science questions that are being investigated at a fairly hefty level.

So I'll wind up with a question myself for just the confusion. It seems to me that all of us, including this board, should really consider the implications of excessive focus on physical science versus social, excessive focus on geologic repository versus centralized storage and transportation. Whether the answer to this is to force it into siting guidelines at this point for a permanent disposal program is about to be overwhelmed by events, I really do not know.

DR. BREWER: Thank you, Mr. Williams. Next on the list is John Petterson. John? And thank you very much for adhering to the time. Please, John. Three to four minutes, if you would, John, please.

MR. PETTERSON: I'll try.

DR. BREWER: And identify yourself and place.

MR. PETTERSON: My name is John Petterson, and I'm coming as Director of the Department of Health Services Studies of 350 sites in California, including 70 superfund sites, so I'm now wearing a different hat. I'm going to address Werner's question because he's not here and he can't respond.

We have very few examples of how mitigation programs have been successfully implemented. We have hundreds in California alone examples of how site selection, Montrose, Delamo. 70 superfunds alone have failed. We've got lots of examples of why it fails, how it fails. I want to bring in, also back on the nuclear waste repository issue, two things. One is time. This is a diachronic problem and we're looking at it as a synchronic problem. This is a major problem. I've used problem several times here.

One hundred years is the way they're currently thinking of it. We all know that it's more like 100,000 years of risk. We have a problem in the United States and on the planet Earth of nuclear waste, which we know is fatal for a million years, and at least 100,000 years, and we created it in one generation. We're going to have to solve that. So that's a moral problem; forget all the risk perception things. We have a serious, serious moral problem here.

Now let's talk about population. Las Vegas alone

has been growing at 6, 8, 10 per cent a year. If we use 10 per cent over just 100 years, not 10,000 years, the population of the valley will be 5 billion people in 100 years, 5 billion. Okay, let's assume it's not 10 per cent. Where will most of these people be living? Well, they'll be shooting up that valley, for one thing. Okay, so we can't consider--we have to consider first the time dimension of 5,000 generations, not simply two or three or five for 100 years. The risks are going to be there. We have a serious problem, and we have to take that into consideration.

Okay, that brings up Jim's point and Doug's point about the Code of Federal Regulations about social and economic impacts, which everybody here is patently agreed we can't do it. This is impossible. We cannot design a mitigation program that will address the problem of 5,000 generations of population at risk. We can't do it. We don't know enough. There are no institutions, there's no examples. It's a joke. Which, coming back to Jim's point again, Jim Williams' point was they'll stick to this. Well, we also know that if there's a problem with the regulations, what we're going to do is eliminate the regulations. This thing is history. Okay, this is in five years, we'll be laughing about that particular criteria.

Okay, do I have anything else negative to say here? Okay, I want to reverse the question for the whole panel to

say do perceptions lead to behavioral impacts, to impacts is a joke. Perceptions are impacts. Those perceptions affect the political process. Those perceptions affect decisions people are making. If you see and can monitor and identify and quantify an economic impact, then you can take that and go back and say now, what are the associated social ramifications and perceptions associated or derived from or some way correlated with that particular impact.

DR. BREWER: Thank you very much, John.

MR. PETTERSON: I'm sure everybody has read my papers, and I appreciate any comments.

DR. BREWER: And we'll be ready for the quiz. Yes, thanks. I'd like to make one technical comment about this particular session of the Nuclear Waste Board. We have used one overhead. It's a record. Is Buscheck in the back?

We have two more members of the public to speak, Tom McGowan and Abby Johnson will be the final speaker. Mr. McGowan, would you please try to keep your comments to about three minutes?

MR. MC GOWAN: Yes, of course. As a matter of fact, I can give you less time than that. I'm reminded incidentally of the famous reply provided by an American general in the Battle of the Bulge to the German demand for surrender, how's this for simplicity, his response was, "Nuts." I will now take off the first page of this, which includes the

amenities, and I'll try to say something nice.

DR. BREWER: It was General McCullough.

MR. MC GOWAN: Was it McCullough.

DR. BREWER: That's right.

MR. GOWAN: God bless him. And if you don't mind, Dr. Cantlon, on behalf of all these fine people, please hand me the proverbial sand box pail and shovel. It's my turn now.

Yesterday's meeting and today's to date was fruitful inasmuch as it exhibited an irrefutably established our current and projected inability to readily address the however ingenious and dedicated scientific and technological, legalistic, probabilistic means of that fundamental issue which is embodied in other nuclear energy or radioactivity per se, but is closely rooted and embodied in the vicissitudes and frailty of inherently quality deficient human nature itself.

In the immortal words of Pogo, "We has met the enemy," has is sic, and it is us. I can eliminate more of this, skip over the good spots, get down to this. With regard to risk perception, and incidentally the correct title of your study should be the perception of risk perception. That appears to be where you're having difficulty.

If we were logical--I'm referring to the variably uninformed or under informed and, therefore, relatively unsophisticated, which you suspect public, if we were

logical, would all be driving Sherman tanks, particularly here, and there would be no such madness as love at first sight, boy or girl. No political pun intended. No, we'd devote our time, energy, expertise and increasingly limited resources to the unconscionable storage and perpetuation of that which quite logically and of necessity must immediately and henceforth be eliminated and irretrievably expunged from our natural habitat, the terrestrial domain, particularly since the rational response, well, it's your alternative, means to do so was readily available for aggressive development and limitation on a national and worldwide scale, and has been available for more than 40 years, which may come as a surprise to at least one person on this universe.

In summary and conclusion, the only virtually insurmountable risk is closely rooted and embodied in our inherently quality deficient human nature, which is vividly on exhibit daily throughout the halls of government and consultant firms. It is literally the only thing in the naturally ordered universe which we can and surely must change permanently and for the better. Thereas, we simultaneously bought the problem and the sole possible solution, which requires a massive fundamental reform and has diametric shift away from special interest and quality deficient and toward utmost quality efficiency in context as applied in terms of ethics, morality, reason, integrity and

responsibility. And not once did I mention science, technology or legalistics, did I, or the domain that is apparently foreign to most if not all of you.

The initiative called a phasal transition initiative originated not by you, but by this individual. You are our public government. Good idea to remember that, particularly on payday. The initiative provides the following. The immediate and permanent prohibition of underground storage of all fissile materials and high level waste completely and permanently.

And in conjunction with that, the immediate prohibition of the transport and above ground storage of nuclear materials, high level waste accepted solely at source of origin and at federal regional facilities dedicated to the national security and defense requisite. Concurrent therewith, a drastic reduction, elimination via scientific and technological means of all forms of toxic radioactivity completely and permanently.

It can be done. You know it; I know it. Any skeptics, I'd be happy to meet out in the hall for the next 15 minutes or so. You can have more than three and you can argue if you wish. Bowman and Venneri are not here to talk to you, nor did you invite them, expediently.

The doctor from DOE headquarters who cited and relied upon the wrong Bowman and Venneri report at the last

meeting of the TRB is the senior technical advisor to Dr. Daniel Dreyfus, head of OCRWM. You are DOE intensive, no question about that. You may not intend to be, but they do. The only problem is DOE, the 28,000 rocket scientists who are now about to look for, can employ them, but DOE doesn't realize it, but their next employer is standing right in front of them. There is indeed a bigger job for DOE and a far more worthwhile enterprise. They haven't even got the slightest idea that it exists, but it will begin to sink in that someone once said to them do things. Nuts, and welcome aboard. My advice to you is, sir, next time give yourself even less time. You would have less to contemplate.

DR. BREWER: Thank you very much, Mr. McGowan.

Abby Johnson, our last public speaker, please. Identify yourself and affiliation.

MS. JOHNSON: My name is Abby Johnson. I represent Eureka County, Nevada. I live in Carson City, Nevada. I just have a few comments about our county and the meeting.

We are one of the nine affected counties that is contiguous to Nye County, the site of Yucca Mountain. Our concern is that one of the--we are under consideration for one of the rail lines that would be built that would bisect our county. We have an economic base of mining and agriculture, and we have been trying to educate our local residents about the nuclear waste issue through a news

letter, and in the issue that's coming out in June, we did a two page piece on perceived risk, sort of Perceived Risk 101, I hope we got it right. And so this is not just a concern for Las Vegas and for metropolitan areas, but for the vast expanse of Nevada, which is rural.

I think there's a lot of counties sitting in the peanut gallery back there, and some of the things, just the mutterings I heard, you know, there were some comments made about the state and that, you know, it's a gambling state, and there's a whole other state, too, the other side of Nevada that's, you know, regular, four seasons, trees, homes, communities, small communities.

I was kind of surprised to hear, I know that the perception of Nevada from the outside is like that, but I kind of got the feeling that that was the perception as well of some of these expert social scientists on this panel, not everybody, but some, and I just wanted to say that if you'd like more information about the rest or Nevada, that we stand ready to provide you with that information. And if you have any questions about our concerns about the project or our concerns about perceived risk, we would be more than happy to provide you with some of that information.

The other comment I have is that it seems like this is not the first time there's been a unique nuclear project in the state of Nevada. The above and underground nuclear

weapons testing was a unique nuclear project, and I think perhaps that there's more similarities than differences. I know DOE will disagree with that violently. But I think we already have some experience, and I didn't hear anybody talk about what we could learn from that experience, good or bad, about how to do it differently this time.

I'd also like to say, as a woman in a man's program, that it was very refreshing to have two women on the panel, and that they contributed a great deal to the discussion and seem to have a very good understanding of what some of these rural concerns are.

Thank you.

DR. BREWER: Thank you, Ms. Johnson.

At this point, what I would like to propose, and the panel has been thinking about this since this morning at least, is to invite each of the panel members in turn to spend a couple of minutes with the take-home lessons of the last day and a half. What are the major messages that the board should take away and things that we should think about as a board, the major messages for DOE, what are the lessons to be learned from spending a day together talking about admittedly some extraordinarily complex and, indeed, judging from the nature and the passion of the public comments, important issues.

So let me begin, we'll just go around the table as

we did before. Gib Bassett, what's your take in all this?

DR. BASSETT: My one minute sound bite I guess is--

DR. BREWER: You can do two or three.

DR. BASSETT: Well, risk perceptions I believe are real and genuine and important. I think it would be a mistake for the board or other people to think that this issue was the device of outside agitators. I've been involved or watched this program for about three or four years, and I'm not totally naive and I know that there are significant political factors which underlie a lot of people's agendas, and it's real easy, given the contentious nature of the debate, for people to think that the other side is ruled by very simple objectives.

I've seen people who are opposed to the repository 100 per cent convinced that this is not a problem, it's a creation of the nuclear power industry to move the nuclear power industry forward. I know people who are pushing the repository who believe that there really is no opposition, that the risk perception is the result of some outside agitators who have come into this arena and begun to stir up the pot.

It's hard not to sort things out in those kinds of ways, and I probably begin to do it myself as well. For me, the focus groups that we ran, and then the subsequent surveys were just a really eye opening experience, because we saw

people not in Nevada, but in other parts of the country who had not been tainted by the kind of debate that's going on here, and you could see that these issues of risk perceptions were genuine. They're not the creation of the nuclear power industry. There are people out there who are motivated solely by that objective. There are people out there who are solely motivated in this issue as a device to stop the nuclear power industry. I'm not denying that is a fact.

But it's important to not just dismiss this as a creation of some outside agitators. There's real perceptions of risk in Nevada that are of concern to the people. I'm convinced of that. I've seen it in the people's faces and I've seen it in the surveys. There are similar kinds of concerns out there on the part of the people who live near nuclear power plants right now. I've seen it in their faces. We've seen it in the surveys.

So I guess the one sound bite I'd leave is that in my opinion, the perceptions of risk issue is real, it's genuine, and it's important.

DR. BREWER: Thank you very much. Doug Easterling?

DR. EASTERLING: I think I'd just like to echo what Gib said. The issue has certainly been politicized from both ends of the spectrum. But I think from all the research we've done, a major lesson is that when you confront people with the prospect of anything to do with nuclear waste, and

especially putting it in the ground, you're tapping into some primal kinds of instincts. You're getting at things that not only are valid and true, but they're deep, and those are the kinds of issues that drive behavior. So I think we really are dealing with real determinants.

I would like to go back a bit to that question that Steve Frishman raised earlier about whether or not the panel would be willing to put on record our endorsement of dealing with risk perception. And I'll go back to the Supreme Court case that Paul alluded to when they ruled that perceived risk related impacts should not be considered in an EIS. And their logic in that was that what you're going to do is encourage people to basically express their dislike for a project in ways that somehow have impacts that have to get built into EISs, and as I just mentioned, I think we're beyond just people being upset with the repository. You're dealing with impacts that are real, both in terms of how people experience it and how they play out in behavior.

So I would really want to encourage the board to encourage DOE to take a deep look at risk perceived impacts.

DR. BREWER: Doug, thank you. Hank Jenkins-Smith?

DR. JENKINS-SMITH: I would endorse looking more at how stigma works. I am not as convinced I guess as Doug that we understand exactly what it is that's going on. I do see lots of opportunity for research along this line to change what it

is that's being measured. And I guess I can imagine circumstances in which monitoring systems themselves become well identified, become politicized, become part of the process, and then become part of a strategic game in the process of engaging in measurement, and I think, you know, that's part of what we would have to think about in a monitoring system.

I guess my feeling about stigma is that we have a lot more to learn yet. I do think that we know that with respect to stigma as conventionally measured, it has to be understood in a comparative context. You can't just use a receiver site centric approach and say bad things happen here. There is no free default option, and in any event, as in any public policy, I think it's incumbent on us as we think about policy in a sensible fashion to try to look at, to compare the impacts of different strategies.

I guess the last point that I would make, and again going back to the visceral gut kinds of feelings that Doug is referring to, one common theme from talking to people and focused group settings and in getting quantitative data and surveys is that people are not happy with a policy that does not appear to be some sort of a real solution to the problem. And frequently and of their own volition people in the focus groups would say hey, wait a minute, you're talking about strategies that really only serve into their stop gap. What

happens when more waste is produced?

The reason I think that we get such a positive response to the idea of attaching the repository with a perspective long-term evaluation of how to reduce the production of these kinds of wastes in the future or reuse them or something along those lines, is that people at least see the policy as having some focus on trying to arrive at a longer term solution.

While we continue to frame solutions that are stop gap, I suspect there's always going to be a well of resistance and dislike for those strategies.

DR. BREWER: Thank you very much. Steve Kraus?

DR. KRAUS: Well, I come at this from a perspective of someone trained as a social scientist and who now works to help business people try to think about how to design research that will help them make decisions down the road. So, you know, before the last few weeks, I really hadn't thought very much about nuclear waste and the issues that surround it.

So I guess my first thought is just, you know, when I see what's going on here and the effort to bring together scientists who have thought about the research issues to discuss them in relatively unpoliticized manner, that has to some extent affirmed my faith in at least this part of the process. So that's kind of one thing that I take away from

it.

One of the other big things that occurs to me is, you know, when we sit down with business people to try to help them make decisions, one of the first questions we ask is well, you know, what are your options. You know, it's really hard just to look at one particular option and weigh the pluses and minuses of that option without looking at what the other options are. And, you know, there's been some very good research by Hank and by others here that kind of address that issue, and I think unless you look at what the other options are, and at this point it looks like the biggest other option is keeping the waste where it is, you know, de-centralized in many places around the country, I think it's hard to talk about what the economic impacts would be in this area without looking at what would the economic impacts be in terms of keeping the status quo or in locating the thing somewhere else.

Finally, I think there's one other line of research that could be looked at quite a bit, and certainly to some extent it has been. You know, we've talked a lot about survey research and using attitudes and risk perceptions and things like that to predict behavior. One of the best predictors of behavior is past behavior. And so to the extent that we can look at behavioral analogues of other situations, I think that can shed some light on what likely

behaviors would be as a result of this.

Now, the problems are obviously there's no single analog that is really precise, but perhaps by looking at all of the other possible analogues, you know, maybe the differences can kind of cancel each other out, and by kind of looking at all the analogues together, some general conclusions can be drawn. And I know some of that has been done. I think it might be worthwhile to look at more of that.

DR. BREWER: Thanks, Steve. Thank you very much. Jim?

DR. OPALUCH: I think when you hear about all the complexities in social science research, it's easy to become skeptical of whether it can shed light on issues at all. But I think that there are very important lessons from the social science research in siting, and ones that provide some clear policy directions.

Probably the most important thing to learn is that process matters, that how we go about siting the facility is a very important determinant of what the impacts will be, independent of any physical impacts. The social science literature I think clearly shows that issues like fairness are important, that people want to be heard, not talked to, that voluntary approaches work best where they're practical. Openness of the process, early participation of people who will potentially be impacted, all of these things are

extremely important as part of the process and important lessons for the federal government, more broadly than just DOE, to hear and to incorporate into decision making.

I guess I'm a little concerned that it might be too late. We're now 15 years into the siting process and, you know, it's kind of late for early participation now.

On the compensation end, you know, compensation must be appropriate, that you can't go in and pay people off. That's I think a clear result as well from the social science literature. And so I think that there are important lessons that are positive that tell you how to go about carrying things out, and so it's not all intractable.

DR. BREWER: Thank you very much. Howard?

DR. SCHUMAN: I came here probably as one of the least informed people about the whole issues here and I've learned a great deal, not only from the panel, but from some of the audience comments. I just want to mention the distinction that's run through much of this morning.

I'm much more optimistic about the possibility of monitoring what happens in a useful way, even though there are many variables and they are difficult and expensive. But I do think that's the sort of thing that can be done successfully on the basis of what social scientists know and other people as well.

I'm less sanguine about what can be done as far as

forecasting what happens, because I think that people have a great deal of difficulty predicting their future behavior, that it's very hard to ask questions without creating demand characteristics that feed back something we more or less expect, that there are likely to be events in the near future, in the more distant future that make for radical changes, that the importance of organizations that mobilize people for and against different actions become extremely important.

So I would simply say that monitoring I think deserves a lot of discussion, and some good ideas have come out here. Forecasting I'm much less optimistic about. I do think that the last comment about process is very important, because that again says that we can't forecast what's going to happen, but we can shape what's going to happen to some extent, and the kind of process comment is in that direction.

DR. BREWER: Howard, thank you very much. For a person who doesn't know anything about nuclear waste, you have added some real insight. Paul?

DR. SLOVIC: I feel that the format of the last day has worked very well in helping us air all the relevant issues and findings and complexity of the research. So I think we really have hit upon the issues and problems, and I don't feel that there's major areas that we haven't touched on. I feel I personally have had the opportunity to express my

views. I don't like to repeat myself too often, but I would agree with my colleagues here that the issue of process is one that keeps coming up again and again, that perception of risk is ultimately about values and, you know, politics to a great extent, and we have to look at it from a question of how to improve the processes by which we make these decisions in our democracy, and the issue of trust keeps coming up.

We didn't perhaps focus on trust as much as we should have, but we know that trust is asymmetrical. You know, you can lose it very quickly, and then it takes forever to build it up, and you may not be able to rebuild it once you've lost the confidence.

And as I mentioned yesterday, a great deal of effort went into trying to advise DOE about how to deal with the trust issue, and I think it would be important for the panel to revisit that and ask, you know, what has DOE done to respond to the recommendations of that report, and if they have done very little, why is that and is that not a worrisome sign.

DR. BREWER: Thank you very much. Elaine?

DR. VAUGHAN: Just a couple of comments. Some common themes that have run through some of the comments here and public comments, it really underscored for me how important the issue of framing is. And framing of issues is important to understand how individuals respond to situations of risk,

but also at a policy level when we're talking about mitigation, compensation and effective solutions, the efficiency and effectiveness of solutions could change depending on how the problem is framed.

It's clear from a lot of the research that's been cited that the public framing of this issue is very different than what's been a traditional strictly technical definition, and that has so many implications where these groups may have different terms of a debate, what solutions are seen as being viable, and it actually could lead to exacerbation of conflict between the DOE or other regulatory agencies and the public if you get together to talk about issues but there's a different framing of the problem and there's been no effort to somehow come to a negotiated or cooperative framing of issues. So that would be the first point.

The strength also of the attitude behavior link can change depending on framing of problems. Some framings of problems really underscore values that are deeply held. If you frame this issue as an issue of equity, for example--my common theme that I keep hammering on--but if you frame it as that, that brings up issues of rights, justice and fairness. People may respond, may have a tendency to respond to those issues in behavioral ways much more strongly than if the issue were framed from another perspective. So that's important.

Also, I think it's very important to look at the social cultural context of risk management, that the public is not homogeneous, that people, some kinds of people will have behavioral options, people are constrained by their social context in which they operate, so some people may have a choice, for instance, whether or not to visit Las Vegas, whether or not to retire here in this part of Nevada. But other people will not have choices, but that does not mean there are no impacts. For people who do not have choices, there still may be impacts on quality of life, as Paul and others have brought out, and those impacts matter as well.

Also, we have to remember that--and I think the last public comment was something that we should all consider--that there are eight counties other than Clark County that border on this site. It includes industries like mining, agriculture and ranching, and there are other kinds of industries, other kinds of populations, and in order to come up with reasonable solutions, then I think you have to look at the social demographic profile of the other communities and what possible impacts might differentially effect different groups and populations.

So hopefully the analysis will not be too focused only on, let's say, Las Vegas because there are other possible impacts that are also important.

DR. BREWER: Thank you, Elaine. Lee?

DR. WILKINS: I'd like to echo the comments about process, and actually although we are 15 years into the process on this one, I think there are some processes where early public participation would be quite helpful. Those refer particularly to mitigation strategies, to getting in early and now and asking people how they think this could be mitigated.

I'd like to put just a little bit finer point at a couple of other things that folks have said, and maybe a different way. We've spent a lot of time the past couple of days talking about impacts on individuals. And while that is important, I think one of the things that perhaps needs an equal amount of attention is the impact of this siting and the subsequent decisions on social and political systems, not merely individuals, but on the groups, communities, et cetera that those people come together to form.

It seems to me that particularly in the political sphere, there are a lot of potential impacts that we haven't talked about that may be quite crucial to how this project is or is not finally carried out.

The last thing I'd like to say, and I think almost everybody has said it in a different way, is if I had one thing to tell DOE, it would be that they need to come back to Nevada and listen some more to the non-technical sorts of concerns that people have, particularly as those concerns

reflect on issues of ethics and morality as they are tied to this disposal problem.

I think that in addition to allowing people to vent, which is sometimes a real good idea, that that may help DOE understand the frame that the public is carrying into that debate, and with perhaps a change in frame, there may be some alternate visions about how at least some partial solutions to this could be accomplished.

DR. BREWER: Thank you very much.

This is a hard one to summarize. It says that I'm going to summarize the meeting. I'm sitting here taking notes and I think it can be done in a couple of words, at least in terms of what I've just heard and what I've been listening very intently over the last couple of days.

Risk is real to some people. There's a need to listen. Listening means communicating. Communication is respect. There isn't a single public out there; there are multiple publics and they are carrying around a large collection of interesting baggage that we have to take account of. Passions matter, and I think that also comes clear in what we've all experienced and learned.

The state of the social science is imperfect, but so is the "real science." The issues, because the difficulties and the complexities of the social science are so important, we probably run grave risks in turning our

backs or ignoring it or treating it with less respect--and there's that word again--in physics or chemistry or the other sciences that are involved.

That's my view of what I think we've heard here in terms of summarizing what you've shared with us. This has been a wonderful experience. It was an experiment on the part of the board. We knew that these were questions that at some point we had to engage, we had to listen. We have been blessed I think by having a diverse professional and caring group of people serve on this panel. And on behalf of the board and my colleagues, I'd like to thank you individually and collectively for a wonderful, wonderful session. Thank you very much.

And with that, I will, if John has the benediction, John Cantlon?

DR. CANTLON: One of the few options for the Chair.

Yes, I would like to commend the panel and the audience for the participation. This has been an excellent and useful session. I would make one observation. We have in many of the phrasings of the challenge that we face talked about DOE as the other. It's important I think for us to understand that DOE is essentially moving ahead with a mandate given to them by Congress, which really represents out representatives.

DOE isn't a monolithic unit doing its thing

independent of a set of laws, acts and so on, and that milieu is changing dramatically today, and it changed a few years back, and one can look at it. So to demonize a federal agency and the people that represent it, I don't think is helpful. This is not a DOE/Nevada problem or a DOE/nuclear energy problem. It is a national challenge in which the federal government has been all over the map, because the people who send those representatives there are all over the map. So it's a lot more complicated than the simple demonizing of DOE.

Thank you all for coming.

DR. BREWER: Good. With that, the meeting is adjourned.

(11:35 a.m. - Whereupon, the meeting was adjourned.)

A P P E N D I X

Appendix A: Impact Assessment, Inc. responses.

Appendix B: Impact Assessment, Inc. verbal presentation.

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