U.S. DEPARTMENT OF ENERGY

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PUBLIC WORKSHOP

DISCUSSION ON ISSUES PERTINENT TO
RULEMAKING TO DESIGNATE FISCHER-TROPSCH DIESEL
FUELS AS ALTERNATIVE FUEL UNDER
THE ENERGY POLICY ACT OF 1992

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WEDNESDAY
OCTOBER 16, 2002

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The Public Workshop met in Conference Room 1E245 in the Forrestal Building, U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, D.C., at 9:30 a.m., Doug Brookman, Facilitator, moderating.

DOE TEAM PRESENT

DOUG BROOKMAN Facilitator
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LINDA BLUESTEIN DOE
TERESA ALLEMAN NREL
STEVE BABCOCK Antares
RICH BECHTOLD QSS Group
JEFF CLARKE NREL
LORRAINE COX DOE
SID DIAMOND DOE
SHAB FARDANESH DOE
DAVE GELMAN Antares
MARC GOODMAN
BOB McCORMICK NREL
KATHLEEN NAWAZ NREL
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PARTICIPANTS

STUART BRADFORD	Shell International
STEPHEN COLVILLE	Sasol Chevron
ROBERT FREERKS	Syntroleum Corporation
CYRIL KNOTTENBELT	Petro S.A.
NICK LAWSON	CONOCO Phillips
BARRY LAWSON	DOE
GREGG SKLEDAR	Sasol Chevron
DAVID SOWARDS	Syntroleum Corporation
SHERRY TUCKER	Tucker Associates (on behalf of Rentech)
IAN VIRRELS	Shell Global Solutions
STEVE WOODWARD	Syndroleum
PAUL WORHACH	Nexant

C-O-N-T-E-N-T-S

P-R-O-C-E-E-D-I-N-G-S

(9:43 a.m.)

MR. BROOKMAN: Good morning, everybody and welcome. This is the U.S. Department of Energy's public workshop on issues pertinent to rulemaking to Designate Fischer-Tropsch Diesel Fuels as Alternative Fuel under the Energy Policy Act of 1992. I'm glad you made it here this morning, despite the rain. We're going to start this morning with welcoming and introductory remarks by Steven Goguen. He's the team leader, Fuels, Office of Freedom Car and Vehicle Technology.

MR. GOGUEN: Give us a second here. There is it, thank you. Okay, we're there.

Welcome, this the DOE workshop on possible designation of Fischer-Tropsch Diesel fuels as alternative transportation fuels and this comes under the Energy Policy Act of 1992. And as mentioned to you, I'm Steve Goguen, the team lead of Fuels Technology in the Office of Freedom Car and Vehicle Technologies. My presentation today is focused on fuels related activities in our office as is this workshop that we're here today, so it's relevant to that although there are a variety of other things that we work on in the Office of Freedom Car and Vehicles Technologies.

Our CIDI program activities are the mainstay of the work that we actually do in Office of Freedom Car and Vehicle Technologies. We also have the responsibility for the leadership in the partnership for Freedom Car. The CIDI program is a program that had come about during the days of the -- people remember this, the PNGV program. It's still an active program in our office. It pretty much represents the mainstay of work that we do associated with the funding we receive and it's designed and put together to promote the use of CIDI technologies in light duty, medium duty and heavy duty vehicles.

Along those lines, we have activities focused in three major areas, and this is the R and D side of our house. It's fuels, emission control and combustion. I won't get too much into detail on any of these except I'll briefly go over the fuels activities and put things in perspective in terms of how we look at things.

In the fuels activities we are diligently looking at right now near term issues associated with sulfur effects on emission control catalysts. As we know, there are some very stringent emissions regulations coming out in the near future from EPA and they effect the CIDI technologies all the way through light duty all the way down through the possibility of using it as a light duty vehicle and it's going to require the use of after-treatment technologies on these engines which has not been used in the past and one of the issues that we're studying right now in detail in cooperation with industry is looking at sulfur effects on these after-treatment devices which are going to be needed.

We're also looking in terms of some oxygenate development, in terms of how to enhance engine out emissions upstream of the emission control devices and we have a program called advanced petroleum based fuels and in that particular program, we are looking at petroleum based products as the mainstay of a base fuel with a use of additives. I guess the arena we might be talking here might be considered to be in some cases even replacement fuels but to be blended into petroleum based fuels to enhance the emissions characteristics and performance of those fuels to meet future engine requirements.

We also have some work going on related to our sulfur activities in which we're looking at fuel sulfur traps, looking at the idea of being able to -- the sulfur fuel taking sulfur down to 15 parts per million. The fuel sulfur trap is an in-line fuel device that would be a replacement type cartridge device that could take sulfur levels significantly lower than the 15.

The advanced petroleum-based fuels activity are critical enabler to allow high fuel economy of diesel powered vehicles to be maintained while meeting future engine emission standards. The possibility is we'd have high fuel economy, light trucks and SUVs by supplanting diesel technology. I'm going to go back and forth between CIDI and diesel because they're both synonymous with one another. Looking for high fuel economy, medium and heavy duty trucks that meet EPA regulations. As I mentioned, the regulations coming out for the heavy duty trucks are going to be very stringent, and the light duty vehicles all the diesel are going to have to meet gasoline standards which are Tier II standards, which are extremely low in emissions.

Looking to enable CIDI engines to achieving even lower emissions than Tier II, we see the possibility for that. We want to incorporate in our program to meet our overall goals at the department level is to incorporate as much as practicable. Domestic feed stocks as need fields and blending agents into petroleum based diesel fuel.

On the other side of our house, Linda will get up and give a presentation here and it falls under our team activities now is the work that we do on the Energy Policy Act. We're looking at a variety of different areas. We have fleet operator -- we have the fleet program and we have regulatory program. The alternative transportation fuels utilization addressed in EPAct Titles III, IV, V and VI are what we work under. Titles III and V are the most relevant pertaining to our office.

EPAct seeks to promote both alternative fuels, those used in high percentages, and other replacement fuels which are non-petroleum fuels used in conventional vehicles and that can include lower blend levels. As I mentioned earlier, our R and D program has quite a bit of activity looking at similar type things. All of the alternative fuels listed in the statute require special vehicles. That's if you have a very high percentage use of alternative fuel, it's been our experience that the vehicles require significant modifications to be able to operate on that alternative fuel.

However, replacement fuels, which could be used in blend levels with petroleum based fuels, we found some experience to indicate that these can be used in conventional vehicles as well which has quite a, I think, possibility for being implemented with less friction than in the alternative fuel sense and have major benefits to us as well.

FTD, if designated, would be first an alternative fuel for use in conventional vehicles and for some of you that are familiar, bio-diesel that has special provisions is not an alternative fuel. For today's workshop, this represents a part of the first formal step in the rulemaking process I know you're all familiar with and we have some technical review and evaluation to present to you today. We're looking for opportunity here to get input from stakeholders which we look to you as and the public on key technical areas before going forward with the notice of proposed rulemaking.

Following this workshop, there will be a comment period which will be open until November 15th. DOE will review all comments including those from this workshop and those submitted in writing to the docket. We'll decide whether to go forward with the notice of proposed rulemaking to designate

Fischer-Tropsch diesel as an alternative fuel. To date, DOE has identified a considerable body of data related to Fischer-Tropsch diesels. It's not new to us. Environmental and health, engine security impacts which is generally -- shows to be generally promising. DOE analysis has also raised a number of questions. This workshop and comment period were designed to help DOE get public input and answers to these specific questions.

That's all I have for you and Sid?

MR. DIAMOND: It says Fischer-Tropsch diesel fuels. It is in the plural. Can you clarify that for me?

MR. GOGUEN: Well, I would rather -- I can clarify that in a real general sense. I don't want to get into a real discussion here because I'm going to leave that up to some of the presentations we have coming but Fischer-Tropsch fuels can be produced from different feedstocks, I think in -- and in different processing of the fuel. I think the actual molecular make-up of the fuel can differ, vary. I think some of the general characteristics of the fuel the bulk properties of the fuel tend to somewhat remain the same.

MR. DIAMOND: Thank you.

MR. BROOKMAN: Thanks very much. I'd like to give everyone a chance to introduce him or herself. Steven has already introduced himself. May I start with you, Kevin? I'm going to go around the room this way, your name and your organizational affiliation, please.

MR. STORK: Kevin Stork, DOE, Fuel Program.

MR. BROOKMAN: Thank you.

MR. DIAMOND: Sid Diamond, DOE, Materials and (inaudible).

PARTICIPANT: (Inaudible)

MS. TUCKER: Sherry Tucker, Tucker and Associates on behalf of Rentech.

PARTICIPANT: (Inaudible)

MR. WOODWARD: Steve Woodward, Syntroleum Corporation.

MR. SOWARDS: David Sowards, Syntroleum.

MR. COLVILLE: Steve Colville, Sasol Chevron.

PARTICIPANT: (Inaudible)

MR. SKELDAR: Gregg Skeldar, with Sasol Chevron.

MR. VIRRELS: Ian Virrels with Shell.

MR. WORHACH: Paul Worhach from Nextant.

MR. BROOKMAN: Can I hold it and I'm going to go to you, sir. Yes.

MR. SMITH: I'm Doug Smith, (Inaudible).

MR. BROOKMAN: And then to you.

PARTICIPANT: (Inaudible)

PARTICIPANT: (Inaudible)

MR. BERGEN: Steve Bergen, ICRC in Detroit.

MS. MINUE: (phonetic) Venessa Minue, Japan Automobile Standards International Organization.

PARTICIPANT: (Inaudible)

MR. JOHNSON: Jack Johnson, Exxon/Mobile.

PARTICIPANT: (Inaudible) American Petroleum Institute.

MS. ALLEMAN: Teresa Alleman, National Renewable Energy Laboratory.

MR. McCORMICK: Bob McCormick, National Renewable Energy Laboratory.

PARTICIPANT: (Inaudible)

MR. BECHTOLD: Rich Bechtold, QSS Group.

MR. GOODMAN: Marc Goodman, I'm an independent consultant.

MS. BLUESTEIN: Linda Bluestein, Department of Energy.

MR. GOGUEN: Steve Goguen, Department of Energy.

MR. GELMAN: Dave Gelman, Antares Group.

MS. NAWAZ: Kathleen Nawaz, National Renewable Energy Laboratory.

(Audience introductions off the microphone.)

MR. BROOKMAN: Thank you. Thanks to all of you for being here early this morning so we can get a good start on this day. I think we have a very interesting workshop for you. I'm going to do an agenda here, agenda review here very quickly. The general format of the day is that we're going to have a series of presentations this morning, some of which are rather technical, and then go from there to brief comment and presentation opportunities for those that responded in writing to the Department of Energy.

We're going to move from there to trying to answer a series of rather specific questions about data gaps and data needs and then follow on towards the end of the day with a more conceptual discussion. You can see and I hope all of you have a copy of the agenda and the presentation materials are on that back table back there. I hope as you walked in the door you got a copy of those because we'll be tracking them and observing them as we go along today.

We're going to start off this morning with an introductory overview from Linda Bluestein. We'll go from there to an assessment of Well-to-Wheel energy use and greenhouse gas emissions by Michael Wang. We'll take a break around 11:00 o'clock. Following that Robert McCormick is going to give a talk on assessing pollutant emissions from natural gas derives vehicles -- derived fuels. I'm used to right side mousing. Around about 11:45 we're going to take a lunch break. You're on your own for lunch.

I'll give you some instructions about where you can get lunch that's here in the building. Immediately following lunch we're going to have brief comments, summary comments, from Petro S.A., Rentech, Shell International Gas and Syntroleum related to their written comments that have been filed. Round about 1:45 we'll be starting a discussion specifically on data gaps, have an afternoon break.

Following that, in the generally 3:00 to 4:00 time frame, we'll be discussing more conceptual issues. We wanted to see if we could uncover and describe data that's possible to be obtained early on and see if we can uncover those gaps then, before we move to the broader discussion. We intend to adjourn at 4:30 today and I think that's probably a pretty realistic estimate. It's possible we may end a few minutes early. Questions, comments on the agenda?

Let me ask you the important question; does everybody feel like the issues you came here to discuss that they fit or they will be successfully embedded in the agenda as written? Yes? I'm looking for heads to nod so I get a clear indication. Okay, thank you.

A few housekeeping items; as I said at that outset, wear your visitors badge, your badge while you're in the building. There's serious about security in this place. The rest rooms are down at the end of the hall this way and they're stacked in a column all the way up and down this building. So if that one is full, you can go up one floor. The coffee shop is downstairs on the other side of the hall. I guess I'll say that again when we go to break. If you haven't yet registered at the registration table over here, please do so, so the Department of Energy knows who is here and correspond with you.

This session today will be taped. We have a court reporter present. These microphones, you need to speak literally into them or they won't work. So I'm going to ask for your consideration, please. Pass them along to the person next to you to make sure we get everything you say on the record. Let me see, how many of you are familiar with these rule making proceedings generally? So less than half the room is familiar with that, so Steve, your comments at the outset about how those work, I think are especially relevant. If you have questions as we're going along today about how these rulemakings generally proceed and how this workshop fits into the larger framework, please ask them.

Let me see, finally, I'm going to ask for your consideration. Over the span of many years we've done a whole lot of these public workshops and they've all worked well because people have been willing to observe and adhere to some general norms, which I think are not much more than common courtesy. I'm going ask that you speak one at a time. Please say your name for the record. Listen as an ally. There's an unfortunate thing that happens a lot on Washington where people don't listen, so when they start speaking, they look pretty foolish.

Our experience in these workshops is people are very willing to listen as an ally and they've done a good job of that. Please keep the focus here. If you can make your comments concise. Turn off your cell phones or put them on buzz, there's another word for that, isn't there? Vibrate. If you have to have a sidebar conversation with someone, the person sitting next to you, if it's going to be more than about 30 seconds, please take it out of the room. You'll distract people and we want to keep the focus here today. I'm going to be queuing people to speak by name. I also wish to entertain and encourage follow-on comments so we get as much dialogue as possible. So if I drop you out of the que, don't let me get away with it. Start waving your hands, okay? Inevitably, I'll do that at least once.

And also I would say this is an opportunity to come forward with a lot of good information to inform DOE's decision making process and about whether they proceed with this or not. So I would encourage you to just cease this opportunity today and we will just stay really focused on the task at hand, okay? Having said that, Linda Bluestein.

MS. BLUESTEIN: Hi, everyone. I would like to take a minute before I start to introduce my regulatory team so that you know who the people are if you've questions and their roles and responsibilities in this rulemaking. Of course, you know, we're dealing with a highly technical subject. I, for one, didn't know anything about Fischer-Tropsch diesel to speak of about a year ago and so I've a team of experts that have helped me and helped to guide me through the entire Fischer-Tropsch diesel rulemaking process.

First of all, we have QSS, who works as a premier consultant to the Department of Energy and we want to thank Rich Bechtold in particular and Melissa Lott (phonetic) for their technical advice and editorial skills, particularly on our discussion papers and our other information and Mark Goodman, who works as a subcontractor is an independent consultant and works for QSS. And he was a lead on the discussion paper and has provided advice to me throughout the process.

Then we have engineering researchers and authors. Bob McCormick and Teresa Alleman from the National Renewable Energy Laboratory who actually wrote the analysis on criteria missions that's now in the docket and Michael Wang of Argonne National Laboratory, who analyzed the fuel with respect to greenhouse gas emission through is widely used and well known GREET model; Kathleen Nawaz of NREL, who has been helping to keep this group organized and on track and meeting all our deadlines, along with Steve Babcock from Antares Group, who has also been helping to organize various facets of the workshop.

Other people that I'd like to mention are Dave Gelman from Antares and Jeff Clarke from NREL, who are extremely knowledgeable people about regulations and worked with me on our state and field provider regulatory program for enforcement and compliance with that program. Shab Fordanesh, who is not here at the moment works with the Federal Fleet Program and she works really hard to insure that the federal fleets are using alternative fuels and acquire more alternative fuel vehicles.

Lorraine Cox has also been a tremendous help in putting this workshop together and I'd also like to thank Vivian Lewis who is our attorney from the General Counsel's Office and who has the difficult assignment of reviewing everything that we send out the door. Well, with no further ado, I would like to get started on a rather lengthy presentation that describes the information that has come out of our technical reviews and information about how this regulatory process might pan out.

MR. BROOKMAN: You're a little bit loud. I think if you speak in a normal voice they can pick you up.

MS. BLUESTEIN: Okay. That is my normal voice. I'm from Chicago. People say folks from Chicago speak loudly, so I'll try to tone it down and be a little bit more Washington, right?

Anyway, this workshop represents the first part of our formal rulemaking, actually it's a step in the first part of our formal rulemaking process which is to evaluate the technical information and data available to us, in this case which came in from petitioners and some from literature reviews that we did. And then based on numerous questions, we wanted the opportunity to get inputs from stakeholders and the public on key technical areas before going forward with the notice of proposed rulemaking.

Section 301(2) of EPAct is the driver here. That really is what authorizes us to designate alternate fuels, new alternative fuels by rulemaking to the list that's already in place. The list, you know, currently includes, you probably read it if you looked at our docket but it includes things like natural gas, E85, propane, those are some of the original EPAct fuels. There were some added later.

DOE has to evaluate three different criteria in order to designate a fuel an EPAct fuel. And these three criteria are listed in Section 301(2) of the original legislation. And basically what it says is that DOE must look at these three criterias, which are the fuel must be substantially non-petroleum, that there are substantial energy security benefits and that the fuel also yields substantial environmental benefits. Most of you probably know this but the Fischer-Tropsch process begins with feed stock. In this case we're looking at natural gas, that is reformed into synthesis gas and the synthesis gas is reacted into hydrocarbons, including waxes, liquids and/or gases and then the reactor output is refined into final products including distillates.

One of the three petitioners, Petro S.A., formally Mossgas and they actually provided us a petition, has a process that differs somewhat from this. DOE has been considering a rulemaking to add Fischer-Tropsch EPAct fuel for a number of reasons. DOE is really considering this rulemaking based upon several factors. First of all, there is commercial interest in production of the product as evidenced by more than a dozen plants that are currently in existence in some stage of planning or under discussion and DOE's Office of Fossil Energy in particular has funded research. DOE received rulemaking petitions from three entities, which are Rentech, Petro S.A. and Syntroleum, which are all here today, who going to be giving presentations, in addition to Shell International who is not a petitioner.

The possible rulemaking right now is limited to diesel fuel made from natural gas, including landfill gas and while this rulemaking was largely prompted by the three petitions, the data was rather limited for purposes of us making a decision.

DOE performed its initial technical review using the petitioners' data with other information compiled by the regulatory team and National Lab partners here in this room. NREL studied criteria emissions data while Argonne analyzed greenhouse gas emissions and process efficiencies using its GREET models which will be discussed later.

Technical review documents have been placed in the online docket that was announced in the Federal Register Notice. There are copies of the Federal Register Notice on the table if you did not get one. The documents are available for public review and comment and we are hopeful that most of you have reviewed them prior to this workshop. Presentations by Argonne and NREL analysts today will provide overviews of the findings and their papers and NREL will also present some newer findings as well.

Generally, after looking at the information that was provided to us and doing our search, we found out that FTD could provide environmental benefits if fuel parameters are adequately defined. We will discuss this concept in the NREL presentation and later in the afternoon and those benefits can -- we also found that those benefits can occur if greenhouse gases are not significantly increased and other environmental concerns such as toxicity, biodegradability and materials compatibility are addressed. Existing emission studies indicate FTD fuel properties are likely to result in tailpipe emission reductions.

FTD is substantially non-petroleum -- generally DOE also found, sorry, FTD is substantially non-petroleum. It is virtually all natural gas derived. The fuel can provide substantial energy security benefits. The benefits are a result of abundant and geographically diverse supply with a longer supply horizon than petroleum and the location of existing plants is also diverse.

Reserve/production ratios are greater for gas than oil and will likely remain that way for the next 20 years barring a major shift to natural gas base transportation sector. Of the plants existing or under consideration, only three are located in the Persian Gulf area. The natural gas feed stock based FTD would constitute either production of new energy or gas that would otherwise be reinjected. Therefore, FTD helps lead to a net gain in non-petroleum energy produced. This contrasts with merely doing something like rearranging an existing refinery stream of NGLs for example.

I skipped a slide. Okay, just one moment, sorry. We also found that related to the issue of energy security, DOE did find that FTD's production is potentially less energy efficient than petroleum refining. Analyses suggests a range of energy efficiency losses for different process configurations. The Argonne report will highlight these findings. DOE is requesting comments and options for energy efficiency including designated FTD without a process efficiency control based on other energy security benefits or another possibility is setting a process energy limit such as energy use per barrel of fuel produced.

For example, Rentech and I believe Petro S.A. proposed a maximum of 11.5 million BTU per barrel of Fischer-Tropsch as a limit for processed energy. DOE is leaning toward a generic designation rather than proprietary designations for this fuel. And we are seeking recommendations on appropriate parameters for FTD sold to EPAct covered fleets. These include potential production process parameters and fuel specifications to insure that the fuel DOE designated is environmentally beneficial. And there are some reasons that we like this idea. A generic designation is more efficient, control parameters can be set and applied equally to all producers and technologies and furthermore, DOE has not seen any analytical links established between proprietary technologies and benefits. Moreover, fuels from various FTD production technologies have a number of similar characteristics.

To go forward with a positive rulemaking decision for a designation of FTD, DOE needs input on how to balance various factors and criteria in making fuel rulemaking decisions. In this case, DOE needs help especially in assessing the trade-offs between criteria pollutant reductions and possible greenhouse gas emission increases. DOE is analyzing several environmental factors to understand the environmental impacts of FTD. These include greenhouse gas emissions, criteria pollutant emissions, toxic pollutant emissions and impacts to groundwater, marine environments related to biodegradation and eco-toxicity.

We think FTD has positive or neutral impacts compared with petroleum diesel on all these environmental factors except for greenhouse gas emissions, but we have concerns over a lack of conclusive data on some of them. For criteria pollutants, DOE would like to see a wider range of data to help understand the relations between FTD properties and emissions. This will be detailed in the NREL presentation in our interactive session.

For toxics, DOE would like to see speciated emissions data and for biodegradability and eco-toxicity we would like detailed composition data and any help we can get on what tests to use in addition to any existing test data. In particular, our analysis leads us to believe that FTD appears beneficial for criterial pollutants. The data and analysis in the NREL studies suggest reductions to current and future petroleum based fuels, N0x reductions of six to 20 percent in pre-1998 engines and we expect generally lower particulate matter, hydrocarbon and carbon monoxide emissions.

Existing data overwhelming show N0x and PM reductions but DOE has concerns about various data gaps and the data's overall representation of real world conditions. In particular DOE does not have enough information about in use fuels, the different types and conditions of engines tested and lacks information on future emissions from -- I'm sorry, emissions from future engine technologies. Although almost all data shows emission reductions, the data is widely scattered in terms of the amount of reductions. This will be discussed in detail in the NREL presentation.

We mentioned before the generic rulemaking makes sense because FTD fuels do share some common attributes. These generally are near zero sulfur, very high cetane, aromatics near zero, almost wholly n-paraffin content and low density. Most FTD fuels produced to date seem to share these properties, yet it's not clear if future in use fuels will completely share them. DOE needs a clearer understanding where fuel composition is headed.

Here's a potential scenario that might bear out and that we would be concerned with. If the high n-paraffin count causes cold flow or elastomer problems, the question is will in use fuels then be isomerized or blended with aromatics. That leaves us to ask will isomerizing sacrifice emissions reductions because of cetane loss? Will isomerizing or other hydro-treating result in higher levels of cycloparaffins and degrade emissions?

Specific FTD fuel qualities are determined by plant specific factors which include feedstock quality, specific process configurations, co-products produced and steam and/or electricity exports. Operating conditions such as temperature and pressure differences seem to influence the current weight distribution of the hydrocarbons. Also post-synthesis choices effect fuel quality. All FTD involves some post-synthesis refining, though the extent and type of refining depends upon production technologies and other factors just mentioned and the desired product quality and mix.

These refining operations include product separation, cracking of heavier fractions, conversion of lighter fractions and isomerization. Specific FTD qualities are also determined by catalysts/reactor design but DOE has seen no evidence of final fuel quality as determined significantly by proprietary technologies. It is possible that different production technologies have advantages associated with certain product characteristics but no one has made such an argument to

DOE, nor have they proven it analytically and such advantages or disadvantages would not conclusively determine differences in fuel quality. Therefore, we believe that any regulations should focus on the fuel's environmental qualities and process environmental impacts and let the market determine which technologies are advantageous to meeting the regulatory requirements. We recognize that difference in process effects fuel quality and because Petro S.A. conversion of oliffins to distillate process is different from straight FTD, the fuel composition is somewhere between FTD and conventional diesel at 10 to 15 percent aromatics and 53 cetane.

Our findings underscore some deficiencies in FTD emissions for the purpose of the rulemaking -- I'm sorry, FTD emissions studies for the purposes of the rulemaking. There are no studies of FTD in alternative fuel vehicles. As I will discuss soon, the EPAct program is effected by the alternative fuel designations our programs for AFV acquisition but the available emissions data is for FTD and conventional vehicles. There are also no studies with emission control devices, little data comparing FTD to ultra low sulfur diesel, little data on post-1998 engines and the range of vehicles represented is not statistically representative of the vehicle population.

Here is some additional findings from our review of FTD emissions studies. There are large emissions reductions with FTD versus Number 2 diesel and pre-1998 engines. Some studies are significantly significant for individual vehicles and tests. There are statistically significant non-zero emissions reductions for pre-1998 engines, but no statistically significant quantitative estimates of emission reductions. Ideally, DOE would like to base its evaluation upon a higher volume of data points, a wider range of engine technologies represented, far more data on post-1998 engines and engines with emissions controls, more data comparing Fischer-Tropsch diesel to ultra-low sulfur diesel, detailed composition data on testing control fuels for all of these tests and speciated emissions data.

One problem we ran across in our review of data is that fuels used in emission studies are not necessarily representative of future in-use fuels which I referred to before. Detailed fuel specifications generally were not provided in these studies and it was not clear that fuels represented in these studies were in conformity with the ASTM D-975 standards. Some fuels used in these studies appeared to be nearly 100 percent n-paraffin leading to possible cold flow problems and elastomer shrinkage with zero aromatics. Two of the three commercial producers of FTD apparently have concerns about marketing of near total n-paraffin FTD.

Bob McCormick from NREL will be talking about the relationship between emissions and fuel properties and what inferences can be made. The next slide represents some possible fuel property parameters that might produce more desirable outcomes to insure emissions benefits. I will skip the next two slides because they are redundant with NREL's presentation.

There will be an opportunity for comment after lunch in the interactive session and in the individual comment sessions about these parameter ranges that we have up here and we certainly are looking for written comments to the docket and they are particularly encouraged.

GHG emissions were also part of the mission DOE and it's lab partners undertook to understand the properties of Fischer-Tropsch and their effects on the environment. Stand-alone production of FTD results in nearly twice as many GHGs as the production of ultra low sulfur diesel but GHGs from the combustion in vehicles are seven percent lower for FTD than ultra low sulfur diesel. GHGs from use of the fuel and vehicles is two to three times greater than GHGs from production of the fuels, so the seven percent advantage of FTD combustion offsets a significant part of FTD's excess GHGs in production. Limited data indicate FTD provides four percent greater per BTU mileage than conventional diesel. I am not sure that we can explain this one, so we are asking for more data to help us understand that.

Per mile, GHGs appear two to 13 percent higher for FTD than conventional diesel with an average value overall of eight percent higher. This means when the FTD advantage and fuel combustion and the fuel economy differential are factored in, the overall increase in GHGs is only about eight percent largely because the high production emissions are diluted by lower combustion emissions. Michael Wang will show this effect in more detail in his presentation.

Other findings with regard to GHG emissions include FTD GHGs vary by production technologies, site specifics and operating conditions as well as other factors. FTD plants that export steam and/or electricity could have lower per mile GHG's than conventional diesel. Argonne credited FTD plants that export steam and power with associated GHG savings. With FTD's improved combustion fuel economy, well to wheel results for these plants overlap the estimates for conventional diesel and could be slightly positive or slightly negative. If FTD were made from gas that would otherwise be flared, GHG reductions would be very substantial. The potential for flared gas may be relatively minor however. If gas if flared, it would be difficult for us to determine whether this would be an indefinite situation. Flaring is illegal in the United States and being eliminated across the globe. We conclude that the regulatory baseline should be reinjection of gas not flaring.

We do have some decisions to make if we go forward with the rulemaking on how we would potentially or if we would potentially control greenhouse gas emissions. And three options that we're putting out there for your comment and any information you can provide us that would be helpful are the potential of no control, where we assume greenhouse gas emissions increases are small enough to be acceptable in light of criteria pollutant emissions, or we could have a maximum GHG emissions per unit of fuel output. Or we could designate only Fischer-Tropsch diesel from plants with steamer electricity exports or using flared gas.

But we believe that steam or electricity exports will be impractical it appears for many FTD plants due to non-proximity to market places. We have other environmental findings that we looked at and we couldn't conclude that much but we could conclude that FTD exhaust is probably significantly less toxic than conventional diesel exhaust. On that we have seen no animal testing or speciated emissions data specific to Fischer-Tropsch diesel identified by any of the petitioners or anywhere else and Syntroleum submitted some data on emissions of key toxics.

DOE also looked at differences in toxicity between aromatics and paraffins since FTD has lower aromatics and more paraffins but had to make some inferences about the emissions products of the FTD versus conventional diesel. FTD biodegradation is probably comparable to conventional diesel and DOE reviewed some studies on FTD biodegradability but the data is limited and inconclusive. We also looked at issues regarding oxygenates. Since oxygenates are often co-produced with Fischer-Tropsch diesel we took a look at them, too.

Oxygenates can be reduced to minimal levels with post-synthesis refining. Rentech in its submission, proposed a limit of one percent oxygen and I believe Petro S.A. concurred with this. This actually is five to 10 percent total oxygenates in FTD. Specific oxygenates are not identified in the FTD literature and thus health effects are not established. We would like to get comments on setting a .25 percent oxygenate limit except for those that have submitted Tier 1 and Tier 2 data to EPA.

Diesel fuel manufacturers typically use a variety of additives for various purposes. While FTD properties are superior to conventional diesel in some regards, there may be some issues with lubricity and perhaps other fuel issues. DOE comments on whether specific additive requirements should be included in a possible designation of FTD as alternative fuel. And this is my favorite subject because I run fleet programs under Title V. Basically, we have a situation where we have a diesel fuel being introduced and our program has traditionally been a lot more focused on light duty vehicles. In fact, the whole vehicle -- or the whole program is focused on the acquisition of alternative fuel vehicles. That is actually how you get a credit under the Energy Policy Act.

They get one credit for each light duty alternative fuel vehicle acquired and then they can get a credit for meeting the heavy alternative fuel vehicle acquisitions once they meet those light duty vehicle requirements. Now that's EPAct requirements. Conventional diesel vehicles are not considered alternative fuel vehicles even if they can use alternative fuels without retrofit. FTD, however, can help fleets meet their EPAct requirements and the Federal Fleet Executive Order requirements. And basically they can do that by fuel providers are required to use alternative fuel in alternative fuel vehicles and they can basically help the fuel providers meet that fuel use requirement but in terms of getting credit for use of the fuel, that is something that DOE does not have authority to give.

Each federal agency is required under Executive Order 13149, that's the Federal Executive Order, to reduce its petroleum consumption by 20 percent from a 1999 baseline by the year 2005. These fleets would probably show the most interest in using Fischer-Tropsch diesel. Fuel provider fleets would also use FTD toward meeting their fuel use requirements, as I said before, which would not earn them credits but would insure compliance with EPAct fuel use regulations. And FTD could be used in dual fuel, alternate fuel vehicles which is not a particularly large segment of the EPAct market.

One issue is that under the fiscal year 2001 Appropriations Act, there was language added that included a statement that after the word "natural gas" in the EPAct definition of 301(2), after the word "natural gas", they inserted "including liquid fuels produced domestically from natural gas". This allows domestic gas to liquid products, even those that might be potentially more environmentally detrimental, but DOE is bound by the statute unless Congress amends it, all domestic GTL is currently considered alternative fuel.

DOE believes only a small volume of FTD, however, will be produced domestically. Of the 14 planned FTD plants that have been identified or the dozen, I guess, that we know of, only one was domestic and that project was now -- has now been dropped, but there are some semi-commercial plants that are producing or, I guess, being planned in the United States.

The review of the major themes and issues that we want to carry forward into the next part of our workshop are that, you know, DOE is really interested in doing a generic designation. It wants to set fuel specification ranges to assure that emission benefits and process energy limits for efficiency are -- we may want to include them and so that is one major theme and that is one major area that we'll be discussing this afternoon on our interactive session. And we need to very carefully discuss the benefits versus any detriments. And we discussed before greenhouse gas emission increases and how do we balance those against the criteria pollutant emission reductions.

The other themes are that we have outstanding data and information gaps. And that conventional vehicles are not AFVs irrespective of their FTD use. All domestic gas to liquid is treated as alternative fuel under the Acts until Congress amends -- until or unless Congress amends the statute. And we have some next steps but I think rather than dwell on the now so much, I'd probably like to go over them this afternoon at the closing. I mean, basically we do want to make a decision on designation. That's our next step and we can discuss the rest at the wrap-up later today.

Anyway, I want to thank everybody for coming to Washington, if you're from out of town, and hopefully the weather will clear up for you and you'll be able to get outside a little bit and enjoy nice fall weather instead of soggy mess.

MR. BROOKMAN: Maybe we should ask now if anybody has a quick question or two for Linda based on the presentation and then we're going to go to our next presenter. Quick question or comment before we move on? I appreciate your discipline. It's going to be helpful, I think if we get through the presentations and hold the questions till the end. I see none. Okay.

Our next presenter is Michael Wang from Argonne National Laboratory.

MR. WANG: Good morning. As Linda mentioned in her presentation, Argonne was asked by DOE to evaluate well to wheels energy use and the greenhouse gas emissions effect of Fischer-Tropsch diesel relative to petroleum diesel, so here in my presentation I'm going to make a brief presentation about what we did at Argonne for this rulemaking process.

Considering the nature of today's workshop, in my presentation I'm not going to go through the great technical details of, you know, what's behind our methodology, assumptions and so on. Instead I'm going to concentrate on the methodology overview of key assumptions we had as a result.

As some of you know, Argonne has developed a GREET model which represent greenhouse gases regulating emissions that are used in transportation for well to wheels analysis of transportation fuels. This diagram here shows what is a typical well to wheels analysis. Typically, we start with feedstock recovery. For example, for gasoline, we start with petroleum recovery and we carry it all the way to a vehicle combustion of the fuel produced.

The GREET model document are available in Argonne's GREET website so you can go to these websites to download the model and the report and some presentation materials. At present, there are about 350 GREET users worldwide, including government agencies, industries, universities and research institutions and the GREET model was used for this study. You know, this chart take you one more step to go through what are the key steps for inclusion Fischer-Tropsch diesel well to wheel evaluation.

And noticeably we have two branches of the well to wheel evaluation for Fischer-Tropsch diesel. One is based on the so-called North American natural gas feedstock. The other branch is based on non-North America natural gas out of flared gas. In our analysis we only covered the non-North America feedstock. There are two reasons for this. The first reason is, as Linda presented, the production of Fischer-Tropsch diesel in North America will be limited. And secondly, the Congress already add some language in 2002, in 2001 proposition act to designated it's domestically produced Fischer-Tropsch diesel as alternative fuel. Of course, we know there are some possibilities to produce Fischer-Tropsch diesel in Alaska so in that case we will have North American natural gas based Fischer-Tropsch diesel, the well to wheels evaluation would be similar to non-North America gas production since we're going to use ocean tanker to transport Fischer-Tropsch diesel from Alaska to continental United States.

So this is the branch we evaluated in our study. The three boxes we highlighted in green are the key stages in our evaluation; natural gas and flared gas recovery and natural gas and flared gas processing and of course, Fischer-Tropsch diesel production. So these are the key three stages for Fischer-Tropsch diesel well to wheels evaluation.

Here is a summary of some of the key issues for estimating Fischer-Tropsch diesel well to wheels energy use and greenhouse gas emissions. Of course, energy and carbon efficiencies of Fischer-Tropsch diesel plant are key factors. Here efficiencies are defined as output energy or carbon divided by input energy or carbon. Fischer-Tropsch diesel plant general design options. As Linda presented, we evaluate three general design options, namely, stand alone plant design, which produce Fischer-Tropsch diesel, and some other product. We included two co-generation plants design. The first one is co-generation electricity together with Fischer-Tropsch diesel and other product. And the second one is co-generation of steam together with Fischer-Tropsch diesel and other product.

And of course, as Linda said, after post-synthesis refining choices are important options to determine plant efficiency both energy and carbon efficiencies. And natural gas feedstock depend on whether we use North American natural gas, non-North American natural gas or non-North America flared gas, we could have significantly different results for greenhouse gas emissions especially between conventional gas and flared gas and of course, combustion efficiencies of Fischer-Tropsch diesel vehicles.

So if we see the differences in efficiency between Fischer-Tropsch diesel and petroleum diesel, that will have the effect on well to wheels energy use and greenhouse gas emissions. And of course, in our analysis we did a comparative analysis where we compared Fischer-Tropsch diesel with petroleum diesel. So it is important to characterize our baseline petroleum diesel. So this is a simple flow chart to show you what we include for petroleum diesel fuel cycle analysis.

Two key stages in the petroleum diesel analysis, petroleum recovery and petroleum refining to diesel. So those are the two key issues we dealt with in our analysis for petroleum diesel. This is a simplified flow charts to show you our system for Fischer-Tropsch diesel plant analysis. As I mentioned both energy efficiency and the carbon efficiency in the Fischer-Tropsch diesel plant are the key factors to determine energy and the greenhouse gas emission effect. To calculate or estimate energy and carbon efficiencies we draw this system for our Fischer-Tropsch diesel plant. And as you can see, for some plant design besides the three key stages as Linda presented in her presentation, we could have air separation. In this case the technology is based on oxygen. So we include energy use for air separation in that case.

Or depending on the Fischer-Tropsch diesel plant design, we could have electricity or steam cogeneration, so in this case, we do include those stages. But overall we consider all the input here on top and output on the bottom to unit plant energy and carbon efficiencies. We address these two products, steam and electricity in a different way as we address diesel, and other liquid fuel product. This is our table to briefly summarize some of the key assumptions we used in our analysis. As you can see for diesel refining efficiency, we assumed 85 to 89 percent energy efficiency.

And as you notice from this table, we have the so-called minimum value, the minimum value and the maximum value. This is for our probability basis simulation to address uncertainties in the key input assumptions. So we arranged to address the uncertainty. So because of the methodology we use, we generate result with probability distribution attached. So this way we do try to address the uncertainties associated with both petroleum diesel fuel cycle and Fischer-Tropsch diesel fuel cycle.

Instead a implied efficiency, energy efficiency from 54 percent to 68 percent, so this red covers most of the plant designs we've seen in open literatures and from these three applications to DOE. And of course, for electricity cogeneration plants design the efficiency based on the liquid fuel products lower than standard plant design but on the other hand, you do have electricity credits generated together with the efficiency you see based on the liquid fuel product. And similarly for steam cogeneration plant, you have steam together with liquid fuel product. And overall for carbon efficiency, we used about 63 percent to 80 percent. Again this is carbon what we see from open literature and from petitioners.

So those are some of the key assumptions we use in our analysis and in the next three charts, I'm going to present the result from our analysis. And let me explain the scheme of the chart's designs for the three charts. For all the results here the results for each million BTU of fuel used by Fischer-Tropsch diesel vehicles, that's why you see about one million BTU for the green bar across the five options. The green bars here are the so-called pump to wheel stage. Normally it's vehicle operation energy use because we assume a million BTU produced --

used, this is same across the five options.

The yellow bars here are the so-called well to pump stages. So here is the result for basically for production, distribution, activities. The blue lines are each bar represents the uncertainty range for well to wheels result. So the line here represent the uncertainty range. The top of the yellow bar represent the mean value or the average value of the well to wheels result so you can see the uncertainty range around the mean value and we have five options here.

The first one conventional diesel was 350 PM sulfur. The second option is ultra diesel with 15 PM sulfur and the third is Fischer-Tropsch diesel plant designed with stat or non-design. The fourth is Fischer-Tropsch diesel plant with electricity cogeneration and the last is Fischer-Tropsch diesel plant design with steam cogeneration. The first chart here represent total energy use well to wheel basis. As you can see, in almost all the cases, actually, in all the cases we do see increase in total energy use from petroleum diesel to Fischer-Tropsch diesel.

And the total energy use here primarily is fossil energy use, namely petroleum, you know, these two cases, natural gas and the other three cases. But if we look at petroleum use the result is very different. At now surprise me, the three natural gas based Fischer-Tropsch diesel options has virtually no petroleum use. The small amount of petroleum use is related to the transportation activities of Fischer-Tropsch diesel from non-North American locations to North America. So basically we see you virtually eliminate petroleum use by the use of Fischer-Tropsch diesel.

For greenhouse gas emissions, the results is different depending on different plants design. Greenhouse gas emissions here include carbon dioxide emissions, mission (phonetic) emissions and nitrous oxide emissions, so that's three key greenhouse gases added together with the global warm temperatures. So here are the results of the equivalent of these three greenhouse gases. As you can see, as Linda already summarized in her presentation for stand alone plant design, with uncertainty taken into account we see somewhat increase in greenhouse gas emissions on a well to wheels basis.

But for the electricity and the steam cogeneration plants designs there is some overlap. For electricity cogeneration plants, there is some overlap in greenhouse gas emissions relative to the two petroleum diesel pathways and for steam cogeneration plants designs there are more overlap and in some cases you could see a reduction in greenhouse gas emissions. And Linda already mentioned the three plant design potentials in your worldwide. In our analysis in Argonne was based on just technology feasibility. We're not saying which option is more technical feasible, we're saying if you use this design, this could be the results you get and if you use that design, this is the results you could get. Your reality, you pick one of the three designs and it's going to be a location specific issue.

It's going to be an economic issue. So we're not saying because this one give us large greenhouse gas benefits, we're saying this is the design people will go for. That is the choice of plants designs will be very much on location and economics. So in summary for each unit of Fischer-Tropsch diesel available for use in vehicles, as production consumed more total energy and fossil energy of production of petroleum diesel.

However, use of Fischer-Tropsch diesel almost eliminates petroleum use relative to use of petroleum diesel. Production of Fischer-Tropsch diesel cause higher greenhouse gas emissions than refining petroleum diesel. But with the export of steam and electricity, greenhouse gases could be reduced to levels comparable to petroleum diesel.

And combustion of Fischer-Tropsch diesel use nor greenhouse gas emissions the combustion of petroleum diesel. This is mainly because Fischer-Tropsch diesel there is less carbon compared to petroleum diesel. And well to wheel greenhouse gases from Fischer-Tropsch diesel appears to be typically somewhat higher than petroleum diesel but in the most favorable cases, they could be comparable or somewhat lower. This is end of my presentation. Thanks for your attention.

MR. BROOKMAN: Thank you. Questions or comments following Michael's presentation? Yes, Kevin. Please use the microphone. I'm going to have to keep reminding you, these microphones are old technology, you need to get them in your face.

MR. STORK: Okay. Michael, I applaud your inclusion of error bars in your -- or uncertainty bars in your graphs, but it also suggests that your conclusion that there's any difference between the greenhouse gas emissions is not true because if you look at your -- I mean, they're all overlapping on the greenhouse gas chart. I would say there is a difference in the energy of the WTW, well to wheels. See they all overlap, so that sort of suggests to me -- I mean, if you're using -- if they're real uncertainty bars, that suggests there is no difference.

MR. WANG: Statistically, if you do a statistic analysis between this bar -- these two bars, you should see some differences. The differences is not conclusive for your most -- the worst case of diesel, worst is the best case of Fischer-Tropsch diesel. In other words, you can conclude there is no change here or there.

MR. STORK: So these are best and worst cases.

MR. WANG: Right.

MR. STORK: These aren't actual uncertainty bars based on your model.

MR. WANG: Right.

MR. STORK: Okay, I'm sorry, I thought you meant those were statistical uncertainties.

MR. WANG: Yeah, basically, you can consider this as the best case, this is the worst case.

MR. BROOKMAN: Yes, please say -- can I ask everybody to turn your table tent toward me so that I can read it? Yes.

MR. WOODWARD: Yes, Steve Woodward with Syntroleum Corporation. Michael, on your well to wheels analysis, you considered the diesel to be North American source and in fact, U.S. reliance on imported food and products is growing tremendously. What would be the effect if it was non-North American diesel in your analysis? How much does that add and how far would the error bars overlap?

MR. WANG: You are right, we assume here the assumption about your petroleum diesel is non-North American production, but for the crude recovery, we do consider both North American and non-North America crude production because we do import close to 60 percent of crude from offsite of U.S. So here this does include both.

This is strictly North America refinery results which is very low, you know, compared with refineries in Europe. European refineries has higher efficiencies, so if we use European refinery efficiencies, the efficiencies would be higher so this could be around 90 percent rather than 87 percent. But the reality is we import close to 60 percent of crude for U.S.

but we import very small amount of petroleum product, so we import crude and we produce products ourselves. So that's why we put this as North America refineries rather than a combination of North America and non-North America.

MR. BROOKMAN: Yes.

MR. WORHACH: Paul Worhach from Nexant. Michael, Linda talked about establishing process parameters as one component of determination and looking at your error bars, going back to the greenhouse gas, please, yeah, the best case for FTD suggests something close to perhaps a break even with petroleum and I wondered as I look at the table that corresponds for the non-electricity and non-steam case, that corresponds to 68 percent efficiency for energy and 63 percent for carbon.

MR. WANG: Yes, right.

MR. WORHACH: Would those be potential parameters that would suggest break even then or do you have others?

MR. WANG: I think the answers to Linda and some other people and I did not give any thought as what -- you know, what this mean the proposal limits. I think that, you know, that's up to discussion this afternoon. Linda, if you have any comment to add?

MS. BLUESTEIN: We're going to have a whole interactive discussion and opportunity to address that later in the session.

MR. BROOKMAN: That's a comment from Linda

Bluestein. Yes, sir, please use the microphone and your name for the record.

MR. McNUTT: Barry McNutt, DOE. Michael, on that chart there, your diesel refining efficiency, is that average for all diesel produced or marginal for the marginal barrel?

MR. WANG: This is average refinery efficiencies based on the EOP simulations over several years. Most EOP simulations we will not ever reach analysis based on average crude at your average U.S. refineries.

MR. McNUTT: Do you have marginal?

MR. WANG: No, we do not. I think very likely it's going to be marginal crude is going to be one of the main driving forces and if we think about marginal crude, the marginal crude quantity would be lower than average crude quantity that the U.S. refineries use, so those would -- those marginal issues will put some pressure to reduce those efficiencies.

MR. BROOKMAN: Yes, Kevin?

MR. STORK: Kevin Stork, DOE. I guess as sort of a follow-up to Barry's question, I guess I was thinking he was getting more at the efficiency of the refinery just to say the more expanded, you know, what we call modern refineries are the ones that tend to be able to add capacity and so they tend to be at the higher efficiency, I would think. Of course, you may be at some point processing worse crude, but you know, I would say that the crude pool is more close to average than refiners. You know, you get into a marginality versus average problem more with refining.

MR. WANG: Yeah, that's a good comment. Thanks, Kevin. Yeah, if we think about existing refineries as to change the confinery configuration to meet the new demand or the increased demand for your gasoline over diesel, especially in the U.S. if we continue to increase gasoline production in existing refineries, that will add some additional pressure to refineries and again, the consequence will be efficiencies will go down somewhat.

On the other hand, there are some new technologies the petroleum industry proposes. Those new technologies may push the efficiencies at least maybe to the current level. So we need to locate all those details to address the refineries efficiencies in a better way.

MR. FREERKS: Bob Freerks from Syntroleum. Could you make a comparison to gasoline because diesel or Fischer-Tropsch diesel could be a replacement in gasoline applications as we convert our heavy duty and our SUV fleet over from gasoline over to diesel, a lot of the FT diesel could end up in that type of an application because we would be enabling those vehicles to meet emissions with a cleaner fuel.

MR. WANG: I do not have answer to this question. Again, I think it's going to be more related to the general DOE's rule making process to make that decision and of course, stakeholders general, you know, think which fleet market to penetrate. But I do offer some of your observations based on what you said. If we do believe that we were going to penetrate to the gasoline vehicle fleet to displace gasoline, the consequence of that comparison will be of course, force that we know.

Gasoline refining efficiency is lower than diesel refining efficiency, so we have lower efficiencies for gasoline production. And efficiencies, diesel engines are more efficient than gasoline engine, so for Fischer-Tropsch diesel using diesel engine you have some efficiency again. So overall if you do some comparison you will have more favorable result for Fischer-Tropsch diesel energy use and greenhouse gas emissions.

MR. BROOKMAN: I'll go to a comment by Mark Goodman and then I'm going to you next, Cyril.

MR. GOODMAN: Actually, I think my recollection is off. Anyway, I think Michael had initially done some comparisons to gasoline and as we put all this together, we thought if we were going to use those comparisons, then we were going to have to do comparisons of Fischer-Tropsch diesel and gasoline for criteria pollutants as well and that raised the question particularly between now and 2007 when diesel vehicles will be a lot dirtier and so I think our decision was that we would leave that out and say that for the most part Fischer-Tropsch diesel will be displacing regular diesel.

MR. BROOKMAN: Cyril.

MR. KNOTTENBELT: Cyril Knottenbelt, Petro S.A. Michael, I was wondering, you've used the theme PPM sulfur standard to compare against and I can understand where you're coming from as far as the 2006 regulations, but if one had to reduce the sulfur comparison, FT compared to a crude refined diesel with a sulfur of 10, I wonder if those numbers won't change significantly.

MR. WANG: They will increase energy use for petroleum diesel production from -- so you're basically going to say from 15 to 10 PTM. There is no question because the desulfurization efforts go in petroleum refineries. But surprisingly to me at least the LP results I've seen in the past several years, have followed the energy penalty for sulfur reduction from -- as you can see, from 350 to 15 PPM, the penalty is about two percent difference, but from 15 to 10 the energy penalty is smaller. That is what I show here. So, yes, it will have energy penalty, but it's going to be not us much as you see from 350 to 15.

MR. BROOKMAN: Marc, follow-on.

MR. GOODMAN: Michael, you can respond to this but I think the data that you used probably incorporates the assumption that 15 PPM diesel at the pump is going to be seven, eight, 10 percent PPM diesel at the refinery.

MR. WANG: Yes, that's right, but it's a relevant question. The refineries always need to maintain a safety margin, so 15 PPM actually is something like 10 PPM, but of course for 10 PPM it would be six, seven PPM.

MR. BROOKMAN: Final questions? Okay, we're just about -- yes, go ahead.

MR. SKLEDAR: Greg Skledar from Sasol Chevron. Michael, can you comment on the approach of looking at broader slate of by-products for a refinery when you're comparing refining and FTD processes and how that would effect the view on greenhouse gas emissions?

MR. WANG: That's -- yeah, that's a very good question and let me try to be short and give everybody a short answer. There are two approach -- at least there are two general approaches to address well to wheels issues. One approach is what are presented here a grid based approach. So with this approach, we look at a refinery. A refinery, of course, generate multiple products; gasoline, diesel, residual oil, coke and so on. So one approach is you allocate total emission and energy produced around the product based on mass, based on BTU, based on market value and so on. So whatever the base you find is reasonable, you base that base to total environment and energy burning. That was GREET approach.

In many cases -- in some cases we take different approach. So another approach is what it is to allocate total burns to different products, we're going to take every products together to evaluate each product on your life cycle basis. For example, now rather than to allocate some emission burns to residual oil, we're going to test what's going on with the residual oil. We say residual oil is usually related to the power plant and then if we take a refinery away, we're not going to produce residual oil. So somebody need some other energy supply to me related to the power generation. So you can assume, say, okay, now I do not have a resid to market. Somebody needs to shut down residual oil power plant to build a new nitric gas combined cycle gas powered plant to generate some amount of electricity.

Of course, you see a large difference in your emissions between our residual oil electrical power plant and nitric gas combined cycle electrical power plant. So you allocate the differences between those two electrical power plants to your system which you're intent is to evaluate Fischer-Tropsch diesel.

So that means now you have a large benefit from electrical power -- from electric sector for your Fischer-Tropsch diesel fuel. So when you take this so called system expansion approach so you expand your Fischer-Tropsch diesel system to consider changes in other sectors. And, of course, this way the system expansion approach you get large benefit or larger benefit for Fischer-Tropsch. But now one could question and say, should you allocate to the benefit from electric sector to Fischer-

Tropsch diesel or to electric sector or the electric plant operator. So that's a subjective decision. So that's the first question, one could challenge that approach.

The second question why could challenge that approach is, do I really think my Fischer-Tropsch diesel plant will take a whole refinery away, so I will reduce gasoline production. I will reduce diesel production, and I will reduce residual oil production. Can I make -- can I make a reason to convince people because I build a Fischer-Tropsch plant? Somebody will take our petroleum refinery away. Then I think you're depending on the market condition, your supply and demand of different products especially the diesel market.

MR. BROOKMAN: Thanks for those questions. It's now 11:15. I'm going to suggest we go to break. We're just about on schedule, and we're going to return at -- it's about 12 minutes after. Let's see if we can make it back about 11:25 to start and we're going to have Robert McCormick from NREL presenting next. Thanks for a good start on the day.

(A brief recess was taken.)

MR. BROOKMAN: Our next presenter is Robert McCormick from NREL.

MR. McCORMICK: Good morning. My colleague, Teresa Alleman and I assessed the criteria pollutant emissions from Fischer-Tropsch diesel predominantly compared to conventional Number 2 diesel. At the outset, I'd like to encourage any of you who have comments or questions that don't get answered today or want to point out to us some additional data that we're not aware of, that we'd really like you to contact us.

I'll start with just an overview of everything I'm going to say today. We've reviewed publicly available data on vehicle criteria air pollutant emissions. This includes data in published papers as well as data submitted by the Petitioners. These data are really a fairly limited data set, mostly for pre-1998 vehicles and engines. Particularly heavy duty engine technologies are in a rapid state of change right now, so pre-1998 data is becoming less and less relevant every year. All the existing data is for conventional vehicles and engines rather than alternative fuel vehicles.

Almost every data point in this data set shows a N0x and PM reduction that's significant relative to Number 2 diesel, and we believe that FTD's meeting certain defined parameter limits will reduce pollutant emissions with a high degree of probability in most, if not all, engine technologies. So the remainder of the talk is just to go over these points again.

I'd like to begin with a comparison of FT diesel properties with Number 2 diesel. What I have here is not industry average data or anything like that, just an example of a Number 2 diesel fuel. I've taken an average for what I call direct FT which is FT distillate produced directly through FT reaction and subsequent refining. This is an average of data in several published papers but it's by no means meant to be a full industry average.

And then I've also used data from a couple of different papers on the conversion to distillate fuel. I'd like to point out first that these fuels have on a mass basis a similar energy content but the FT fuels have a lower density which means they have a lower energy content per gallon. The direct FT fuel has a much higher cetane number than conventional fuel. Some measurements suggest it's in the range of 80 to 85. Typically in many studies it's just reported as greater than 74. The COD fuel could probably have a range of cetane numbers but it's typically much lower, about 50.

Both FT fuels have very low sulfur content. Aromatics content is typically around 30 percent in the United States. Direct FT fuel can have very low aromatics content. The COD fuel has aromatics content in the range of 10 to 15 percent. Hydrogen content is in some ways related to the aromatics content, higher aromatics content, lower hydrogen content. FT fuels have significant both direct and COD hydrogen content than a typical diesel fuel.

Cold flow and lubricity, highway paraffinic fuels like normal paraffinic fuels like direct FT, have a cloud point that's significantly higher than that for typical Number 2 diesel. This is the temperature where wax crystals first begin to form in the fuel and you can begin to get fuel filter plugging. The COD fuel can have cloud point in the same range as the typical Number 2 diesel fuel. Both of the FT fuels have what at least my colleagues in the engine manufacturing industry would refer to as poor lubricity. The diesel fuel has to lubricate certain components of the engine, in particular, the fuel pump and fuel injectors and one way to quantify this is in terms of lubricity.

There's considerable uncertainty in the fuel properties in the studies we reviewed, first because the fuels aren't representative of what will actually be produced. In many studies, these fuels were produced at pilot scale or even smaller processed research scale and the properties may change as the process is scaled up. Additionally, as prototype fuels some of these fuels maybe could be considered prototype fuels. It may be that the processor uses some additional post-refining steps to meet customer requirements for cold flow properties or to meet the ASTM D-975 Number 2 diesel specifications.

And then finally, many of the studies provide really minimal or almost no data on the properties of the FTD base fuels tested. In many cases not even the D-975 list of properties much less any chemical composition data.

This slide summarizes all of the emissions data that we reviewed, more than a dozen studies. Emissions changes are relative -- either relative to diesel fuel, a conventional

Number 2 diesel fuel, or an ultra-low sulfur diesel fuel, 74 data points, the data are for heavy duty engines and vehicles and light duty vehicles so they include engine test scan data, heavy duty chassis dynamometer data, light duty chassis dynamometer data, a number of different test and driving cycles. I guess I should say that we are aware that there is additional data out there.

Much of the data we've become aware of since we wrote our analysis is for fairly old engine or vehicle platforms and also data for light duty vehicles that might be more relevant to the European situation and to the United States. But if there is some heavy duty data that we haven't -- that's relatively recent, a relatively recent engine platform that we haven't included in our analysis that any of you are aware of, we'd certainly like to be made aware of it.

So as you can see, almost all the data with the exception of maybe five or six points show significant reductions in one or both of these pollutants. There's a great deal -- and that's relative to Number 2 diesel or ultra-low sulfur diesel. There's a great deal of scatter particularly in the light duty particulate matter data because the light duty particulate matter emissions are quite low levels to begin with.

This is the same data but shown a little differently. It shows the literature data and the data submitted by the three petitioners. The petitioners' data particularly falls in the -- it falls all over the range of the literature data so it seems to be typical of what's out there. Now, as I noted, this data is for all sorts of vehicle and engine platforms, tested against all sorts of Number 2 and ultra-low sulfur diesel based fuels so it might be a little risky to say take the average, because maybe I'm averaging apples and oranges, but I've boldly gone ahead and done it anyway. And we see on an average an N0x production of 12 percent and a PM reduction of 27 percent.

There are certain limitations to this data. As I noted, the fuels tested may not be representative. Many of the studies we reviewed did not report any measure of experimental error, no replications, no error bars and so it was not possible to do a statistical test for significance in the change of emissions for FT versus Number 2. The data exists for a really limited range of model years, engine sizes and engine technologies compared to what's in the in-use fleet in the U.S. today. And so the emissions data are pretty clearly not available for a representative sample of the diesel vehicle fleet.

And so these emissions testing data in that sense in the sense that you have a representative sample of what's out there, are probably not adequate in and of themselves to show substantial environmental benefit for the use of FT diesel across the entire fleet. We do feel that based on the fuel properties of FT diesel, it may be possible to find that there is substantial environmental benefit. There's some fairly well-known effects of fuel properties on diesel engine emissions. Low sulfur content can reduce PM emissions, certainly in going from 300 or so PPM to 15. That's only a marginal reduction in fume emissions.

I think more importantly low sulfur content enables exhaust catalysts and trap technologies. Increasing cetane number can reduce N0x emissions in some engine models but has little or no effect in others. The effect on fume emissions is also engine dependent but I think the most important benefit of increasing cetane number is assisting in cold starting of diesel engines and reduction of white smoke during the warm-up phase. Reducing aromatic content of the fuel also can reduce N0x emissions. A 20 percent reduction could reduce N0x by as much as five percent or as little as zero, depending on the engine model.

Reduction in polyaromatic is likely to account for most of this effect. And the magnitude of the reduction is very engine dependent. PM reductions are also observed in some engines. Now, I'd like to expand on this in my next few slides by showing you some data for specific engine models. It's clearly not all the data that's out there on fuel effects and diesel engines, but it is just examples of how things change as engine technology changes.

First, I have some data here from what's -- what was a well-known study back in the early `90's called the VE-1 study using a 1991 model year engine meeting the five gram N0x, .25 gram PM standard. As you can see, this engine is very sensitive to both cetane and aromatics content of the fuel. Increasing cetane number can get a significant reduction in N0x and PM. Decreasing aromatics can also provide a similar effect, although there's quite a bit of scatter in the PM data. The hydrogen content of the fuel which is related to the aromatics content, also correlates well with N0x and PM.

These data are for a similar, very similar engine meeting the same N0x standard but a reduced Pm emissions standard. Here we see a much less significant impact of cetane number on N0x emissions and also of aromatics. And for this engine and these specific fuels, there was no impact on PM emissions. And here's data for a similar engine but meeting an even lower N0x standard of four gram per brake horsepower hour. Here you see a weak effect of cetane number on N0x but it is statistically significant, and then also a -- probably an insignificant effect of cetane number on PM. Aromatics content was not varied in this study.

Now, in the 2004 emissions standard in the United States is 2.5 gram for brake horsepower per hour of N0x plus hydrocarbon. Hydrocarbon emissions are extremely low from these engines, maybe .1. So essentially this is a N0x standard. Many engine manufacturers as a result of the consent decree they signed with the Justice Department have to meet this emissions standard this month, in October of 2002. So here I show data for two different engines with exhaust gas recirculation which is a technology that most of the engine manufacturers are using to meet the 2.5 gram standard.

For a light duty engine tested in one study, cetane number had perhaps a positive effect on PM in the sense that PM increased but it's a very weak effect at best, but it had a very significant effect on N0x emissions, increasing cetane number, reducing N0x. But for a heavy duty engine with ERG and meeting the same standard, we see no impact of cetane number on N0x. These data are all over the place, but total aromatics content of the fuel, reduction in aromatics content or increasing hydrogen content, produces a very significant reduction in N0x emissions. PM emissions were not reported in that study.

So I think you can see there's not a universal effect for every engine model of these fuel properties but summarized for a fairly old engine, what's getting to be a fairly old engine today, a 1991 calibration, change in cetane number can produce significant reduction in N0x. Aromatics has a similar effect. Moving to a newer calibration engine the impact on N0x becomes less of cetane number or aromatics but in the newer engines, in some technologies, you see a significant reduction, in others you don't but aromatics seems to continue to have an effect.

So cetane number is not consistently associated with emissions reduction even though it clearly has great advantages for cold starting and white smoke as I mentioned. But the effect of aromatic and hydrogen content seems to be consistently positive. It's not always the same for every engine model but it's consistently positive. I guess additional notes to that, aromatic content, hydrogen content and density of fuels are likely to be very highly correlated with one another. And I've mentioned weight percent hydrogen as a possible variable for relating to fuel emission performance but it's not going to capture differences between normal, iso- and cyclo-alkanes and normal alkanes would be expected to have, for example, a much higher cetane number than iso- or cyclo-alkanes.

So I'd conclude by providing -- at least this section of the talk by providing a reason for the impact of aromatic content on N0x emission, it's likely to be related in some way to reduction in ADM flame (phonetic) temperature which is the temperature at which the diesel spray or the hottest part of the diesel spray is burning in the engine. This temperature is higher for aromatics than for non-aromatics and poly-aromatics have an even higher temperature. So I would put forth the idea that the emissions reductions observed for FT are most reliably correlated with the low, total and poly-aromatic content.

But in older engines and heavy duty engines tend to stick around for 15 or more years in the U.S., the high cetane number may also be important. I believe that we'd like to have additional data on emissions particularly a much wider range of engine types, heavy duty engine types, including more post-2002 engines with EGR and prototype engines with advanced catalytic exhaust treatment. Here I mean engines that meet the emissions standards that will be phased in between 2007 and 2010 and that are -- will employ the ultra low sulfur diesel content to be introduced in 2006.

I should note that in a couple studies that are completed unrelated to this rule making, NREL will be doing some testing of newer vehicles and one engine on FT diesel during the coming year. We'd also like to see emission studies with detailed fuel composition data. By this I mean, analysis for a normal, iso- and cyclo-alkanes as well as total and poly-aromatics. I think that would perhaps allow us to sort out the impact of fuel properties on criteria pollutant emissions in a little more detail.

We found very little speciated emissions data, by this I mean measurement of toxic compounds coming out of the exhaust. My belief is that these are likely to be significantly lower for FT fuels than for conventional diesel but I'd like to have it proved to me regardless of whether I believe it or not. And finally, data on durability of the fuel system and potential impacts on engine components associated with emissions has to be demonstrated. It's one thing for an engine to have a dramatic reduction in PNM N0x when it's brand new and first tested with an FT fuel but after it's run on that fuel for thousands of hours, is that emissions reduction still going to hold up?

So to summarize, pollutant emission data are available for a limited set of engine models, not fully representative of the fleet but the available data shows significant PM and N0x reductions in almost all the individual tests. Additional data on newer engines and emissions durability is desirable. It's not clear that these data alone show significant emissions reductions. Emissions reductions may be more directly related to fuel properties of FT diesel and I think I can give you a better idea of what I mean by talking about the scatter on this plot.

The wide range of emissions reductions is caused of course, by experimental error but also clearly by the many different engine technologies that were employed in these studies, the different Number 2 and ultra-low sulfur diesel fuels, this data is not all against a common based fuel and also the different FT diesel properties, a number of different fuels are included here. So you know how are we to decide where the emissions benefits of future FT fuels in future engines will lie. Are they going to be in this range which would seem to be significant environmental benefit, or are they going to be down here or maybe even are they going to fall out of the reduction are in here? It's not entirely clear based on the data on this plot that, you know, what you're going to get.

So we propose that a specification of minimum fuel properties can provide a benefit across all vehicle technologies, and here in my final slide, I just have copied one of Linda's slides asking for comment on fuel parameters for a generic designation. And if I can take any questions now, I'd be happy to.

MR. BROOKMAN: Questions or comments? Yes, name please.

MR. McNUTT: Barry McNutt, DOE. Michael -- Robert, excuse me, do you have any reason to believe that the emission characteristics of the fuels from a physical chemistry and combustion chemistry are any different than the would be for a petroleum based fuel that achieved the same properties? I mean, isn't this a property driven rather than a production driven set of characteristics?

MR. McCORMICK: If you need a petroleum based fuel that was highly paraffinic and a very low aromatic content, it could conceivably have combustion properties identical to FT diesel.

MR. McNUTT: Well, then it raises a question and we'll leave it to the afternoon, about why not specify emission benefits as a functions of properties as opposed to CAPS (phonetic)? I mean, we have all acknowledged you're not sure exactly how these fuels are going to appear in the marketplace or how their properties are going to change.

MR. McCORMICK: I'm not sure what you mean by as a function of properties versus CAPS, you mean versus a model?

MR. McNUTT: Model, yes, exactly. I mean, in fact, EPA has already laid out regulatory -- in a regulatory context the emissions model as a function of fuel properties, albeit, perhaps temporarily.

MR. McCORMICK: Well, and they were massacred by the fuel and engine industry for it. It was not pretty. That notwithstanding --

MR. McNUTT: There's a federal regulatory agency with emissions model out there and we ought to discuss this afternoon about its applicability and what we're doing here because we don't need to re-invent the wheel to get to a point about making a judgment about emission benefits is all I would say.

MR. BROOKMAN: Okay, thank you. Other comments or questions? Yes.

MR. WOODWARD: Yes, Steve Woodward with Syntroleum. I'd like for you to give us a definition of what you call the entire diesel fleet and also you used the phrase end use fleet.

MR. McCORMICK: Those are the same things and they are the entire collection of diesel vehicles being used in the United States today. I'm not suggesting that one would want to test every one of them but --

MR. WOODWARD: But could you narrow that focus as to which diesel would be qualified as alternative fuel vehicles under EPAct that manufacturers could do to make these for these fuel?

MR. McCORMICK: That question, I cannot answer.

MR. WOODWARD: That would not need the entire fleet. That would not need -- that probably would be light duty because EPAct only covers light duty. It does not cover heavy duty, does it not?

MS. BLUESTEIN: Well, you have to --

MR. BROOKMAN: Linda Bluestein needs to make a point.

MS. BLUESTEIN: Steve, well, the issue is, is that for compliance with the programs under EPAct you must comply using a light duty vehicle and once (tape malfunction) compliance level where it's at compliance, it can actually get a credit for acquisition of a medium or heavy duty alternative fuel vehicle.

MR. WOODWARD: Then this fuel would then be applicable for light duty vehicles in the first instance or the first level of compliance and then heavy and medium duty there after.

MS. BLUESTEIN: That's right.

MR. WOODWARD: Okay, thank you.

MR. BROOKMAN: Marc Goodman.

MR. GOODMAN: I think that's a good point, Steve. If this were like other alternative fuels, if there were an existing set of alternative fuel vehicles on the market, that would be the appropriate fleet that we would be comparing and that's where testing has to be done between other alternative fuels. Unfortunately we don't have that, so we're looking at existing data. We're looking at other tests that are likely to be done but yours would be the more appropriate comparison actually for the purposes that we have.

MR. BROOKMAN: Additional questions or comments? Yes.

MR. SKELDAR: Gregg Skeldar from Sasol Chevron. Just a comment on your slide on example of fuel properties, because I know there's been a few comments around --

MR. McCORMICK: Which slide was that?

MR. SKELDAR: The third slide under cold flow properties, I know there's been some concerns or at least that's been raised. My understanding on cold flow is that the refining process as you describe it or the upgrading of the FT product can control that point. In fact, we're looking at controlling to whatever the market requires and that flexibility is a function of this technology on, as you describe it as direct FT. So running at minus 15, minus 20, minus 25, even is impossible.

MR. McCORMICK: But aren't there compromises associated with doing that in terms of lowering the cetane number of flash point or other important fuel properties?

MR. SKLEDAR: The process we're looking at for our facility in Nigeria will have a minus 20 CFPP spec and it will -- typically runs greater than 75 on cetane, so the results that we see in that range are still very consistent with what you're seeing here. So a minus 20 and these typical properties you're showing here are very consistent. Zero is quite low. We haven't -- we really don't do much work in that range.

MR. BROOKMAN: Thanks for that comment. This is the kind of -- this is the kind of data that DOE seeks and we'll have an opportunity to disclose more of this, this afternoon. Yes.

MR. FREERKS: Bob Freerks from Syntroleum. The fuel that we tested and supplied data on was a minus 15 cloud point diesel. It was normal paraffin and iso-paraffin with no aromatics and on sulfur and I believe that we supplied most of the analytical data for that. We have made fuel down to minus 50 cloud freeze four point, so it can be done without significantly burning the cetane in the fuel. It's still above 70. So no problems there.

MR. BROOKMAN: Thanks, that's very helpful.

MR. KNOTTENBELT: There's also the observation of Shell, you still get very high cetane with the lower four points typically with --

MR. BROOKMAN: And how low does it go?

MR. KNOTTENBELT: We will be looking at four points with the same level as Gregg has described, minus 15, minus 20, whatever the market actually needs. There is some reduction in cetane but it's very small. Cetane might drop from 18 to 17 but it's still extremely high compared to any diesels that are available on the market.

MR. BROOKMAN: Thank you. Yes.

MR. WOODWARD: Just one last comment, Syntroleum is --

MR. BROOKMAN: This is Steve Woodward.

MR. WOODWARD: Steve Woodward, Syntroleum. Syntroleum is participating in a DOE sponsored project and we will be supplying the fuel to the University of Alaska in Fairbanks that will meet Arctic grade criteria which means a minus 40, 45 degree centigrade and the cetane numbers still will be close to 70 or perhaps lower. It's not an issue as to whether or not it can.

MR. BROOKMAN: Thank you. Other comments or questions?

MR. McCORMICK: If I can make one comment, based on what I've just heard, perhaps cold flow is an issue that you know, we shouldn't be as concerned about. You know, the ASTM D-975 cold flow specifications may be something that FT diesel can meet and, you know, it's not something that we should be concerned about.

MR. BROOKMAN: I see a few heads nodding up and down. Yes.

MR. FREERKS: Bob Freerks again from Syntroleum. With regards to your comments about the statistical significance of the data, there are ways to treat wide varieties of statistical data and get the significance but your chart basically showed that virtually every test showed benefits. You can drive statistics from that pretty easily.

MR. McCORMICK: And there's -- using a non-parametric test, basically it shows that you basically test whether it's -- is the change positive or negative or zero. And there's a 99 percent probability that both emissions that I showed are going to be produced. The question is, how much?

MR. FREERKS: Yeah, but as you said, that varies from vehicle to vehicle and application to application and speaking of that, the California EPA only requires reformulate diesel fuels to be tested in one engine to be certified for emissions characteristics. They don't care about the vast majority of different engines out there. They chose one representative one and that was good enough.

MR. McCORMICK: But we aren't in California.

MR. BROOKMAN: Nor is this Kansas. Yes, okay. So other questions or comments following this presentation? It's just about time for lunch. I'm going to suggest we go there in just a minute.

Immediately following lunch we're going to have presentations and comments from Petro S.A., Rentech, Shell International Gas and Syntroleum. Following that we're going to go to some rather specific questions that both of our presenters qued up for you. I'm going to read them so that they'll be fresh in your mind when you come back.

The Department of Energy is seeking specific information surrounding the following. Did we list all the questions and make copies of them over there? We did. You've seen these questions. They are, "Any additional FTD emissions data including wider range of vehicles/engine types, conditions, ages, mileages, states of repair, data on post-'98 engines, including engines equipped with emissions control, test data that includes fuel composition data for testing control fuels, test data comparing FTD to ULSD, data from FTD fuel economy and differential to conventional diesel, data on power obtained from FTD and/or low density diesel fuels, durability emissions data, data on cold flow performance with very high paraffin levels", and perhaps that's based on the comments we've already heard, not as important now, but they still want the data, I think, data on comparability of near zero aromatic fuels with elastomeric materials". Okay, so we're going to start off with that following the brief presentations. It's now noon. It's hard to do lunch here in much less than an hour. We'll start back up at

1:00.

For those of you that are unfamiliar with this building, maybe we can just get a bunch of people going at the same time over to the cafeteria. So maybe we can do that. Basically, the cafeteria is in a separate building on the other side of the street over here and the easiest way to get there is to go down one floor and walk all the way under to the other side of the street. And there's also, for those of you that went for coffee this morning, there's a kind of sandwich shop, they sell quite a bit of food right one floor down and immediately opposite us on the other side of the floor here in this corridor.

So other things that we should remind them of at this time? I think we're on track where we're supposed to be in terms of schedule.

(Whereupon at 11:58 a.m. a luncheon recess was taken.)

AFTERNOON SESSION

MR. BROOKMAN: Okay, let's start. One housekeeping item, Linda reminds me that a list of attendees will be made available and will be posted on the website and does everybody know that website address? They ought to, it's in the Federal Register notice and everything else.

MS. BLUESTEIN: It's in the Federal Register notice but it's ott.doe.gov/epact/fuel_pet.shtml.

MR. BROOKMAN: Okay, so maybe I'll write that out.

Yeah, we'll write it down on the flip chart up here for you. Okay, so the format for now is we're going to have four very brief presentations. The first one representing Petro S.A. is Cyril Knottenbelt.

MR. KNOTTENBELT: Good afternoon. Thanks for the opportunity to present this presentation on behalf of Petro S.A. Our sincere thanks to the U.S. Department of Energy for the opportunity. A brief introduction on Petro S.A. and where we've been coming from. We're a state owned commissioned and managed company. Moss gas was established in 1987 to basically reduce South Africa's dependence on crude imports. The company has quite a lot of experience, approximately 12 years in producing FTD diesels and have gone through quite a lot of learning curves with that. In 1999 we petitioned DOE to accept our FTD oil fuels as alternate fuels. Subsequently, Mossgas has merged with Secru (phonetic) also in state and body involved in the exploration of oil and gas and in January 2002, the Petroleum Oil and Gas Corporation of South Africa Petro S.A. for short, was registered.

Just a quick look at the methane reformers, you can see the primary reformers in the background and in the foreground the small secondary reformers and just while we're looking at that Petro S.A. is an ISO 9001 and we were actually the first company worldwide to achieve ISO 14000 environmental managements systems accreditation.

There are three synthol reactors and getting down to business why we are really here. In 1999 we petitioned three basic fuels, RFD1, 2 and 3 and hoped that these would really be achieved or designated as alternative fuels. Quite a lot has changed since then and maybe it's time to look at how one should maybe define Fischer-Tropsch diesel. We feel that Fischer-Tropsch diesel should be defined as gas derived, environmentally friendly but the crux of it really diesel produced by selective catalytic synthesis of hydrocarbons from synthesis gas containing hydrogen, carbon oxides, using Fischer-Tropsch technology where the said synthesis gas is derived from natural gas.

Just looking a little bit closer at some of the specifications of this field and I have changed my presentation somewhat to the handouts that have been given out, if you'll please forgive that. I think we should propose sulfur specification of approximately 10 PPM mass, sulfur being one of the FTD's greatest attributes and a definite enabler of all catalytic exhaust after treatment options.

In terms of aromatic specification, it was interesting to listen to the earlier comments. What we have found is that PAHs should be limited to less than .1 percent volume. Where that will come, PM, N0x, polyaromatic hydrocarbon reductions. In terms of total aromatic specification, we would suggest to go with a 10 percent volume specification.

Just a little bit of background on why we think there may be benefits by using the foreign aromatic limitations; EPEFE, in one of their vehicle fleets that is on the light side of the vehicle fleet study there were 19 vehicles. I'm not too sure how many heavy duty vehicles there were but they looked at changes in N0x emissions and reduction of polyaromatic hydrocarbon content from 11 to one percent resulted in a N0x reduction for the light vehicles of five percent as opposed to two and a half percent for the heavy duty vehicles. Of interest was a relatively small change that took place with the increase in cetane number from 51 to 55. Work that we have done at West Virginia University and this has been reported in Telesis Today (phonetic) 2002 edition, gave us the following results and that kind of led us to believe that maybe the cetane number specification should be a minimum of 50. For a 1992 DDC 6V-92TA, run on an engine dynamometer, as well as a 1998 Navistar T444E also tested on the engine dynamometer, showed significant PM reductions and N0x reductions.

For the 1998 Navistar, we saw a reduction of 14.8 percent over D2 and a N0x reduction of 10.1 over D2. Further conclusions that were made in the study were that there was significant reductions for both engine and vehicle testing. Both two and four stroke engines from different manufacturers over a range of engine technologies, over a range of various dynamometer testing cycles and the presence or absence of after -- exhaust gas after treatment devices. Other parameters that we probably should have a look at and that we'd like to comment on is that we feel that the oxygenate contents should be limited to 1 percent max.

In terms of hydrocarbon type we suggest the cetane number in place of hydrocarbon types. The cetane number will in fact reproduce the paraffin content and if one really went out and analyzed the hydrocarbon type, I can speak for our products but by GC-TOF-MS it's about two and a half days work. But GC is in some of the Shell techniques. I'm not too sure it might be a little but quicker but the long end of it is, it's atime-consumingg and expensive exercise so cetane base is probably a very goodpredictorr of iso-paraffin versus normal paraffin content.

Additives are massed for FTD fuels especially considering that the lubricity enhancements that are required. Additives obviously, should be selected not to disadvantage any positive emission benefits and should contain no sulfur and probably limited at about .1 mass mass percent of the FTD.

Just briefly summarizing, some of the specifications that we felt are worthwhile suggesting was cetane number 50, a sulfur content of 10 PPM max, aromatics of 10, polyaromatics .1, and lubricity or waste core of 460 maximum waste core size. We support very much the Rentech proposal of 11,5 MM BTU per barrel as a process energy limit. In terms of toxicity and biodegradability, toxic characteristics of all FTD diesels will definitely be better than crude based diesels or at least equivalent, at least that could be used at a 96-hour bioassay using Leptocherus Plumulosus or Mysidopsis Bahia. We have done some tests, we can release the results at a later stage, but they were very favorable.

In terms of biodegradability, I think FTD definitely has got good biodegradability characteristics as opposed to crude diesels. They could be used as a 58-day anaerobic biodegradability test or 28-day anaerobic biodegradability test. In terms of balancing the determinations, we really don't have the answer yet but we do feel that fuel quality effects on fuel economy and greenhouse gas emissions should be considered on well to wheels or cradle to grave basis. Petro S.A. being a South African company considering trade agreements with the USA and being a member of the World Trade Organization, we would like to propose that all GTL, both foreign and domestic be treated as alternative fuels, in fact, meeting all three of the EPAct requirements; being substantially non-petroleum, environmentally friendly with good emission benefits and giving environmental security benefits. We feel that we would like to propose this fuel as a GTL for all three petitioners. Thank you.

MR. BROOKMAN: Questions, comments? Marc Goodman?

MR. McCORMICK: It sounds like your process is flexible enough that the three fuels proposed in your original petition, you're not stuck with those, right?

MR. KNOTTENBELT: No, we're simply not stuck with them and I don't really want to go there but at the end of the day when the technology companies actually come to the point of being full production companies. At that time, there will obviously be a drive for chemicals and a drive for fuels. And you'll need to balance up what you've got in your hand.

MR. McCORMICK: Your slide proposed a one percent oxygenate limit.

MR. KNOTTENBELT: Yes.

MR. McCORMICK: I understand you're talking about one percent total oxygenates or one percent oxygen content in the fuel?

MR. KNOTTENBELT: I suggested one percent total oxygenates.

MR. McCORMICK: And the --

MR. KNOTTENBELT: In fact, if I can just go back, the regional data which we presented had a five percent Muscelinal (phonetic) 120 total oxygen content in it. Muscelinal 120 is a mixture of oxygenates, C3s, C4s and we merely just wanted to demonstrate the benefits of PM reduction by the additional of oxygenates to those fields.

MR. McCORMICK: And you mentioned two different sets of emission data there. One was the EPFE. Have you provided those to us, you know, as the original studies with the original raw data?

MR. KNOTTENBELT: Subsequent to the petition, we have published that information in Telesis of Today (phonetic) and the EPEFE data was not reported but if I remember correctly the EPEFE data was in Concowi (phonetic) in 1999 and hopefully, I can just whip it out. It's not in that slide. It was 1999, I think the third or the sixth month in one of the Concowi editions.

MR. McCORMICK: And you'll get us copies.

MR. KNOTTENBELT: I can get you an electronic copy of that. I'll e-mail it to Linda. What I have noticed with the studies that there are quite a large vehicle population.

MR. McCORMICK: Your fuels have the higher aromatic contents than some of the other --

MR. KNOTTENBELT: Right, I cannot specify higher aromatic content and I think when we looked at the EPEFE study we saw the effects of poly-aromatics and perhaps that is something that needs to be looked at, at the future is how detrimental are aromatics versus normal paraffins, iso-paraffins.

MR. McCORMICK: Is it your position that some aromatic content is desirable for purposes of materials compatibility?

MR. KNOTTENBELT: That was a cycle that we have been through is that we tended to pick our problems in the market and we subsequently adjusted the process to have some aromatics around and basically the problem where you normally pick up aromatic compatibility problems is when you drop from say aromatic content equivalent in crude of about 30, 35 percent down to say seven percent fuel. Then you are going to pick up CSR problems. In the case of alternative fueled vehicles, we -- you would run the vehicle only on one fuel. That may not be such a big problem, but I think there's too little data to prove that.

MR. McCORMICK: Do you have any data that you could give us on that?

MR. KNOTTENBELT: We have some in our state and I'll have to discuss it with the management of Petro S.A. before we can release that.

MR. McCORMICK: And finally on one of your slides, your last slide, you propose that we designate all GTL whether domestic or foreign.

MR. KNOTTENBELT: Yes.

MR. McCORMICK: In previous slides you suggested a variety of fuel specifications.

MR. KNOTTENBELT: Right.

MR. McCORMICK: When you say all GTL, what you're talking about is all GTL meeting those fuel specifications.

MR. KNOTTENBELT: All GTL meeting the fuel specifications and looking at those fuel specifications, I think all three petitioners and probably the GTL that other companies would produce without really mentioning names, but I know there are a lot of US companies doing a lot of work in that area, I'm sure would have to meet those specifications.

MR. BROOKMAN: Yes, Michael first, then Robert.

MR. WANG: You mentioned that one of your slides are from well to wheels on analysis of greenhouse gas emissions and fuel economy. As you saw this morning, DOE has done some analysis in this area. So based on what you saw, our analysis was either additional issues or problems that you see it that we need to address from what we found.

MR. KNOTTENBELT: Michael, can I come back to you on that one and it will be in writing, obviously before November, I think it was 15th. And so that we can carefully review that, but that is something that we need to do look at as a company as well.

MR. BROOKMAN: And I guess that I would just add -- I'm going to let you follow on any other persons that you wish to make additional comments on that specific question the Department would welcome that as well. Your name? Please use the microphone.

MR. LAWSON: I've got a good voice.

MR. BROOKMAN: But it won't be picked up on the tape.

MR. LAWSON: Nick Lawson from CONOCO Phillips. Cyril, could you just be very clear about the oxygen spec that you're proposing? Is it weight percent of oxygen or weight percent of oxygenate?

MR. KNOTTENBELT: We were considering oxygenates.

MR. BROOKMAN: Thank you. Additional -- yes, Robert.

MR. McCORMICK: I acknowledge -- you mention the difficulty in measuring the normal iso-paraffin ratio and I acknowledge that that is challenging. But you suggest then using the cetane number in place. If you have aromatics in the fuel is the -- do you think the cetane numbers are really good?

MR. KNOTTENBELT: I think if you've got an idea what your aromatic content is, which is really measured by HPLC IP391 or other techniques, you can calculate what the portion of your cetane number is going to be according to your aromatic content and I think there is some information that exists on weight sites. It's called cetane and the debits (phonetic) and for every molecule in about the C10 to C25 range it will actually give you a cetane number of that, iso-paraffins, olaffins included and I've played around with that for quite awhile now. I actually found that there was a very good correlation between that cetane number. In fact we went up by more than two cetane numbers.

MR. BROOKMAN: Linda Bluestein.

MS. BLUESTEIN: Cyril, I'd like to thank you for your participation today and just also to reiterate something Marc said, if there's a way before November 15th you could get us information from those toxicity tests, that would be much appreciated by the Department.

MR. BROOKMAN: Robert, any additional questions? No? Okay, anybody else with questions or comments on Cyril's presentation? Okay thank you very much. Our next speaker will be Sherry Tucker representing Rentech.

MS. TUCKER: Good afternoon. My name is Sherry Tucker. I'm with Tucker and Associates and I was asked by Rentech to make this statement here today on their behalf. "Rentech, Inc. provides this proprietary Fischer-Tropsch technology for the conversion of syngas made from carbon bearing material into ultra-clean liquid hydrocarbons. The Rentech FT technology is highly efficient and cost effective offering opportunities for project owners around the world to implement the technology to convert under-utilized resources into ultra-clean transportation fuels and chemicals.

Today, under House Bill 12274, signed into law in December 2000, Fischer-Tropsch's fuels from domestic natural gas are designated as alternative fuel. Moreover under the Energy Policy Act of 1992, Fischer-Tropsch's fuels from coal are also alternative fuels. In this workshop we are addressing Fischer-Tropsch fuel made from sources other than domestic natural gas.

Rentech would like to lend its support and encouragement to the DOE in the designation of Fischer-Tropsch fuels from sources other than domestic natural gas to be classified as alternative fuels. Rentech through its internal efforts submitted a petition in July 1999, clearly demonstrating that all three criteria as set forth in the Energy Policy Act of 1992 have been met, that is FT fuel is not substantially petroleum. FT fuel would add substantial energy security benefits and FT fuel would yield substantial environmental benefits.

Rentech is continually evaluating various Fischer-Tropsch technologies from such major energy companies as British Petroleum, CONOCO, Exxon and Shell. Although these technologies all have their differences, each produces very similar ultra-clean hydrocarbon products. Therefore, Rentech believes it is in the best interest of the DOE and the country that Fischer-Tropsch diesel be designated an alternative fuel under the Energy Policy Act of 1992. We recommended that DOE set standards for FT diesel regardless of the technology used to produce the fuel. Our suggested standards are in our letter of October 12th, 2001 to the DOE which was previously attached", and I believe it's on the web.

"The three unique characteristics of FT diesel fuels are the ultra low levels of sulfur, aromatics and high cetane index of the fuels. These three characteristics allow the fuels to burn completely, significantly reducing emissions. It is these three characteristics that the DOE needs to consider as it moves forward in setting the standards that designate FT fuels as alternative to the dirtier fuels we use today. Rentech heartedly encourages the DOE to expedite the designation process as the tenuous world situation and the demand for clean energy in the United States continues to increase.

We need to seek all alternatives, particularly when they are environmentally sound options. Thank you for your consideration and we look forward to a rapid and positive outcome to this technical review and movement towards notice of proposed rule making".

I told Rentech that I would take back to them any questions that the DOE or others may have and I will remain -- because I cannot answer these questions myself. So I won't bore you all with writing down the questions as I stand here but I will remain behind this afternoon and take your questions if you wish to give them to me.

MR. BROOKMAN: Thank you. Let me just get a show of hands, Marc, do you, others have specific questions you'd like to direct to Rentech? Okay, Robert and Michael as well. Others, other than the DOE cluster here? Are there others that have -- would like to direct questions to Rentech? I'm just flagging these so you can see them.

MS. TUCKER: Okay.

MR. BROOKMAN: And I guess just those. Okay, so if you'll write them out because she's going to take them back.

MS. BLUESTEIN: Can we e-mail them to Dick Shepherd (phonetic)?

MS. TURNER: Yeah, you can e-mail them to Dick Shepherd, absolutely.

MR. BROOKMAN: She just said that she's not going to be able to get the answer today. Do you want to ask the question on the record? Sure, go ahead.

MR. BLUESTEIN: We can do this through our docket. We can have these folks write some questions.

MS. TURNER: I knew you were interested in having them for the record and I wanted to facilitate that for you, so whatever method you want to use is fine.

MR. BROOKMAN: Okay, you want to ask a few questions now. Okay, Marc Goodman.

MR. GOODMAN: You said in your statement that Rentech's initial petitions showed clearly that the three criteria are met. Is it Rentech's position that the questions and data gaps that DOE has identified are irrelevant, that, you know, are you saying that the data accompanying that petition was adequate in and of itself on which the DOE could base a designation, is one question.

The second question would be, as I understand your proposed specification, it is for one percent oxygen content rather than oxygenates content. I just wanted to confirm that that was the case, we're talking one percent total oxygen.

MR. BROOKMAN: Okay, Robert?

MR. McCORMICK: My questions are also about the fuel specification. The fuel specification includes cetane index which is not the same thing as cetane number. I guess I'd like clarification as to whether Rentech really means cetane index. Also, the lubricity specification of 675 on HFRR seems to be -- I mean a fuel with 675 lubricity is almost any definition of poor lubricity fuel. I mean, is there some data that suggests that that level is adequate? Maybe I'm wrong in saying that it's a poor lubricity fuel. Maybe Rentech has some data to support that.

MR. BROOKMAN: Michael Wang.

MR. WANG: And my question is about Table 2, the process efficients. Rentech proposed 11.5 million BTU per barrel and I have three questions regarding this number. First is, the eleven and a half million BTU is higher or lower. The second, question is for the barrel here is that all the liquid product or is Fischer-Tropsch diesel only? The third question is what is the basis for 11.5?

MR. BROOKMAN: Those are rather specific questions. Other questions directed at Rentech that they can respond to in the record? Yes, Cyril?

MR. KNOTTENBELT: Just a -- Cyril Knottenbelt from Petro S.A., just a comment that is that it's simply very dangerous to use a cetane index for synthetically derived diesel fuel. The reality it's probably -- and I may be wrong -- closer to a cetane number just above 52, 53. So it would be great if Rentech could clarify whether they mean cetane number on that one.

MR. BROOKMAN: I didn't understand why a cetane index wouldn't work.

MS. BLUESTEIN: That was the same question.

MR. KNOTTENBELT: Steve can probably back me up on this one. I know that Cecil had done a lot of work and we have done some early work and we found the cetane indexes with our top fields and maybe for other FTDs that cetane index tended to exaggerate the number -- the actual cetane number.

MR. BROOKMAN: Robert.

MR. McCORMICK: My understanding the cetane index it a number that's calculated from an empirical correlation of other fuel properties in an attempt to predict cetane number. It's a correlation developed for petroleum diesels that at least compared to the properties of FT diesels have a very narrow range of properties. Any of the FT diesels we've been talking about today are well outside of the range intended by that empirical correlation and so cetane index, it's not an accurate predictor of cetane number for FT fuels. It's -- I don't see why one would want to use it but --

MR. BROOKMAN: Okay, Sherry, I'm certain the Department would welcome Rentech's thoughts on why they included an index as opposed to a cetane number. Other comments, questions before we move on to our next presenter? Okay, I see none. Then our next presenter is Stuart Bradford, speaking on behalf of Shell International Gas.

MR. BRADFORD: Thank you, good afternoon. I'm Stuart Bradford. I work for Shell International Gas which is an affiliate of the Royal Dutch Shell group of companies. I have a colleague from the Royal Dutch Shell group of companies, Ian Virrels who will probably be much better placed than me to answer any technical questions you might have after I've been through this.

I'm not going to read out the statement that we sent in. The statement was specifically addressing some of the questions asked by the DOE in the docket, but instead I'll go through why we think Fischer-Tropsch diesel should be considered as an alternative fuel, looking at the elements of energy security and environmental benefit, and also considering some aspects of how that will actually be used in practice.

Firstly, though, I'd like to talk about what is Fischer-Tropsch diesel. We see two distinct types of Fischer-Tropsch diesel. One is made by so-called low temperature Fischer-Tropsch process and that's the one that Shell is familiar with. It operates the plant in Ventulu Malaysia (phonetic) and will be the basis of most of the future investments announced by Shell and others around the world. We don't have experience with the alternative high temperature Fischer-Tropsch process or as you call it in the docket, the COD process, so we can't comment upon what that process might be.

I think that with us for the low temperature Fischer-Tropsch process, material made from different suppliers of technology or different operators is going to be substantially similar in that we'll have a very high cetane number and a very low level of aromatics. Moving on to why should Fischer-Tropsch diesel be classed as an alternative fuel. Firstly, energy security. Well reserves of gas exceed those of oil in terms of years of production and reserves of gas are growing whereas those of oil are declining.

A significant portion of this gas cannot be monetized by traditional rigs such as pipelines or liquefied natural gas. In detail production is the only way that this gas is likely to be able to find a market. We see detailed production in a number of locations around the world, including but not limited to the Arab Gulf. Detailed production is therefore going to both increase the supply diversity for transportation fuels but also the total availability of feed stock for making these products will also be substantially increased by this technology. And this will have clear energy security benefits for any net consuming nation of energy.

We don't believe that the process thermal efficiency is a significant issue to be considered in whether

Fischer-Tropsch fuels should be classified as alternative or not. Fischer-Tropsch's technology will be applied primarily to gas fields for which there is little prospects of other utilization. And therefore, the fact that the process efficiency is not very high, is in our view, not the significant feature.

Typically, the thermal efficiency of the process would be on the order of 60 to 65 percent. We would say that 60, 65 percent of something is better than zero percent of nothing. With regard to the environment, we've seen lots of data from NREL and others around emissions associated with Fischer-Tropsch diesel end use. The conclusions of NREL are brought in line with the work that we have done in our laboratories, some of which we've submitted to be part of the DOE docket. The work that we've done includes data on fuels with low pour points and fuels that might be typical of those made by Shell and others for next generation Fischer-Tropsch plants and projects.

And this product, as we said before, still shows an extremely good emissions performance and very good cetane number. The question was raised in the DOE docket as whether six to 20 percent reduction in N0x should be seen as significant. We believe that it should. Firstly, when you look at the level of reductions achieved by introduction of other fuels is seen as beneficial, such as low sulfur diesels for many criteria emissions, that's the sort of level improvement that you see. Secondly, gas to liquids diesel will be a very cost effective way of achieving emissions reductions.

Probably in terms of fuel solutions, it will be the best way of achieving this. The alternatives have to go to after-treatment systems. These are under development but they are expensive or in the case of the urea system, difficult to actually manage. With respect to non-criteria emissions, we don't have any direct experimental effort ourselves about whether Fischer-Tropsch diesel would be beneficial but we suspect that probably it would. With regard to ecotoxicity, for ecotoxicity we have submitted data to the DOE which shows that for various aquatic organisms, Fischer-Tropsch diesel is not toxic.

Regarding biodegradability, Fischer-Tropsch is in our view a product that is clearly more biodegradable than a standard diesel and again, we have submitted data to that effect. Greenhouse gases, we believe the position overall is neutral. The Argonne study is clearly a reference work in this area and it's a study to which the Shell Group actually contributed as well. However, it's a study that uses a relatively narrow system boundary definition and the effects of the emissions from the less favorable refinery streams such as fuel oil or coke, and their use in markets as opposed to what you could use as alternative fuels to satisfy those needs, have not been taken into account.

Shell has done a study which includes these effects and have concluded that depending upon what assumptions you make, the net greenhouse gas position of Fischer-Tropsch can be actually beneficial or can be slightly worse as in the Argonne study, depending upon whether you assume that fuel oil and coke produced by refineries is replaced by the natural gas or coal as an alternative. Overall, we believe the Fischer-Tropsch diesel has an extremely strong environmental case being bounced on greenhouse gases and being a strong class or likely strong class on the three other elements.

I think it's quite rare that a fuel actually wins across the board. It's a very unusual position to be in that something is better on all of the elements under consideration. With respect to introduction and use of Fischer-Tropsch diesel, the main issue we see is around compatibility of low aromatics products with the engine seals. This though, I think is a very minor issue and can be managed suitably by a suitable introduction of the fuel with a maintenance program of the fleet. It's an issue that has been addressed successfully by places like Sweden who effectively have zero or close to zero aromatics fuel as being the standard within their market.

Additive packages will be needed with Fischer-Tropsch. Lubricity additive, possibly anti-static additive, anti-oxidants. We don't see these as really being significant to achieving the energy security or the environmental benefits that the DOE is considering for its ruling. They are significant for how the product will be used and for the relationship between the fuel supplier and the customers and distributors of the fuel but we think that's a matter probably best left to the fuel supplier to sort out with the users of the product and would not need a specific ruling from the COE on this matter.

Three other issues that Shell International Gas would like to bring to your attention that weren't considered in the DOE docket. Firstly, Fischer-Tropsch diesel will be an extremely good blending component for standard diesel. We have done work looking at the emissions performance of various blends of Fischer-Tropsch diesel with standard diesels going from zero percent to 100 percent Fischer-Tropsch and we find that the biggest emissions benefits actually occur with the first 20 or 30 percent that you put in for most engine systems. This would, in fact, be an extremely practical way to use the volumes of Fischer-Tropsch diesel that will be available which initially will be limited. So we would like consideration for the use of Fischer-Tropsch in blends to be made by the DOE.

I don't know whether you are able to classify that as an alternative fuel, as we discussed this morning, but there might be some other way in which special consideration could be given to the product used in this way. I think also the DOE should consider the aspect of cost effectiveness and practicality. There are a number of alternative fuel systems that are being proposed. I think one of the very strongest selling points for Fischer-Tropsch diesel is that it's compatible with the existing diesel infra-structure, so distribution and engine systems.

Ultimately government policy directed to energy security or emissions has to be implemented with a cost in mind and that cost is ultimately borne by the taxpayer. Introducing this fuel will be a much lower cost than many alternative fuels that I can think of. And that, I think, should be part of your considerations.

Lastly, I'd like to come back to the point that some other people have made about domestic and imported GTL. We really don't see a reason to differentiate between the two. The emissions performance of the two products will be identical. With regard to national energy security, I don't see an advantage for domestically produced GTL either because domestically produced GTL will use gas from a country which is already importing natural gas. So it's just replacing one import with another.

That concludes the comments that Shell has to make. I'd be more than happy to take your questions. To be more accurate, We will be more than happy to answer your technical questions.

MR. BROOKMAN: Linda Bluestein.

MS. BLUESTEIN: Linda Bluestein. Thank you for coming to our workshop and making the presentation for Shell. I wanted to just point out something on your question regarding using it as a blending agent in 20 to 30 percent blends. You know, one of the criteria that we had to consider under a 301(2) of EPAct was whether the fuel was substantially non-petroleum and it's been the case before that DOE has not gone forward with the request to do lower level blends. We don't have any precedent in terms of any designation of a fuel anything under a 60 percent blend which would be the P series fuels.

If you look at the statute as written, the lowest level one in there for M85 and E85 is 85 percent alternative fuel. So, I guess I just wanted to address it that way. Now, bio-diesel was an exception. D20 is allowed as -- to allow fleets to comply with EPAct. In other words, they can use a certain amount of pure bio-diesel and gain a credit, it's actually 450 gallons, but they had legislation introduced and passed in Congress and we had a separate rule making that covers bio-diesel. So I guess I just wanted to introduce that topic to you and give you the background on it and the fact is that our petitioners -- the three companies that petitioned were not asking for blends either. So we didn't consider anything lower than virtually all Fischer-Tropsch diesel.

MR. BRADFORD: So what would be the way to take this forward if that is the logical way to use the product? What should we actually do?

MS. BLUESTEIN: Well, no, it could be a replacement fuel and used in that type of situation where replacement fuels are called for. I mean, DOE is always looking at goals to increase the amount of replacements to petroleum that won't necessarily get a fleet of EPAct credit. I mean, that's just something that kind of would go toward an overall, y you know, national type of goal that we might set at some point.

But I guess that you know, there probably isn't authority that we have to look at anything below, I would say a 50 percent blend because the word "substantially" is written in there and you know, I think anything under that is not substantial.

MR. BRADFORD: Understood.

MR. BROOKMAN: Yes, Rich Bechtold.

MR. BECHTOLD: Rich Bechtold, QSS Group. You said something and I don't remember your exact words, but you implied that using Fischer-Tropsch diesel might obviate the need for emission control devices on diesel engines. Did I not hear that right?

MR. BRADFORD: I don't think I said that.

MR. BECHTOLD: Okay, well, let me ask you, do you think there are any emissions regulations that using Fischer-Tropsch would meet in place of emission control devices where conventional diesel fuel uses emission control devices?

MR. BRADFORD: Perhaps Ian is better qualified to answer that than me.

MR. VIRRELS: I'm Ian Virrels from Shell. I think if you look at the strategies that OEMs might make, there might be a niche for SMDS in there if they're managing to pull down engine out to a certain level and SMDS might be a help to that, if you're talking about the very stringent levels in the U.S. then perhaps less likely but it may be part of the overall package of such. They would still have the benefit although not doing it by itself.

MR. BROOKMAN: Yes, Michael go ahead. I'm going to ask you again, everybody, please speak into the microphone.

MR. WANG: Can you explain a little bit more on the strategy and to think about the whole approach on the greenhouse gas effect of Fischer-Tropsch diesel, the so-called system expansion approach versus allocation approach. When I see the key arguments, between the two approaches, I see it as an attribution issue rather than as a (inaudible) approach. It's narrow and the other approach is broader. Both approaches address all the products but the view is from any fuel cycle, petroleum diesel cycle and Fischer-Tropsch diesel cycle.

The issue for us, I think to consider is the whole attribute will change with the different product. Should we attribute all the changes to Fischer-Tropsch diesel or should we attribute the changes to UDVU (phonetic) product. For example, if we say (indiscernible) and so furthermore we assume that it's vulnerable to the limits of residual oil, our power plant that we should attribute the additional actions and limit the power plants to Fischer-Tropsch diesel or should we actually to the power generation step. So I think that's is the question you have to ask. Also approaches, your allocation approach allocates the change in emission based on the products used and the system expansion approach as your study laid out, now attribute everything to Fischer-Tropsch diesel fuel, so I notice that Shell's written comments shows we are to monitor Fischer-Tropsch diesel plant efficiency greenhouse gas emissions, it's going to be even more difficult to monitor it, like the (undiscernible) because of your Fischer-Tropsch plant but it's going to be difficult to monitor to make this change. So are we going to make sure the expansion system approach will have (undiscernible) and even it happens as you envision, is it going to fail to allocate all the changes by Fischer-Tropsch diesel? So I think that's the question you need to think about.

MR. BRADFORD: I think that could be an extremely long discussion which we're certainly keen to engage on you with. I think you've seen a copy of our report already, so you're already very familiar with the issues and we're very familiar with your work, having contributed to it. I think there is a philosophical fight around how you do this type of study. Probably all we can conclude at this point in time is that depending how you do it, you get different answers and from our perspective Fischer-Tropsch diesel is not necessarily clearly worse.

And if you make certain assumptions, it could be a better product. So I wouldn't say that Fischer-Tropsch diesel had a significantly higher greenhouse gas emissions proforma than standard diesel.

MR. BROOKMAN: Rich Bechtold.

MR. BECHTOLD: Related to this issue, you had said, or I think I heard you say that in the near term it might make more sense to blend Fischer-Tropsch with conventional diesel and this discussion about displacing residual fuel oil, isn't that further out in the future? I was wondering if you could maybe expand on your vision of how Fischer-Tropsch might fit into various blends over time.

MR. BRADFORD: I think we see opportunities for Fischer-Tropsch diesel both for use of 100 percent product. The best opportunities we see there would probably be with some form of dedicated vehicle. I mean, our real vision is that there is a vehicle that is optimized to take advantage of some of the very unique properties, particularly the cetane, for example, a vehicle with different compression ratios so that you can get higher efficiency out of it. That would be a solution, say, for local bus fleets which come and refuel from a single point.

For broader use of the product, we think probably the blends would be the more applicable route to go because then things like aromatics, low aromatics and seal compatibility, you can manage that very easily on an individual fleet basis. But if you change the whole city over then I think that would be a harder thing to manage.

One world scale Fischer-Tropsch plant can supply an awfully large area as a blend and thereby can make a significant difference to air quality within quite a broad region, so I think that's another advantage of the blending rate. But that said, I think both are very promising opportunities. How will things ultimately go? Well, we don't know. We're a few years away from having product available in large scale.

For the product produced out at Tulu, in the case of the product that Shell recently launched in Thailand, that is a blend and you get quite nice benefits out of a relatively low addition of fuel, which could contribute in a small way to improving the air quality of Bangkok.

MR. BROOKMAN: Marc Goodman.

MR. GOODMAN: Yeah. Following up on that, if you get a disproportionate benefit with the first increment up to 30 percent or whatever of the blend as you've indicated, does it follow that for a given quantity of Fischer-Tropsch diesel fuel you'll get a greater total environmental benefit by blending it at a lower level than by using it as a new fuel?

MR. BRADFORD: It does, unless with 100 percent solution, you adopt a solution you can only use with a zero sulfur, a very high cetane product like an after-treatment system that's extremely sulfur sensitive, for example. Ian.

MR. VIRRELS: This is Ian Virrels again. We did some work looking at gas blended into a 400 sulfur with fuel from a European market and we found that the emissions were very comparable with a low sulfur diesel on site at the UK which is approximately 30 PPM. So using that, if you like, it goes much, much further and using at 100 percent. So we see the blends as being quite beneficial in that you get more for your buck on N0x reduction.

MR. GOODMAN: In regard to the materials compatibility issue, you've suggested mitigating that by a controlled use of it in fleets, but within EPAct fleets and may fleets in the U.S. generally, particularly light duty fleets, we find that a lot of them actually, even though they're considered centrally fueled fleets in a regulatory sense, they actually refuel at liquid refueling stations. And you know, it's a pretty good bet that it's that station, that truck stop or whatever switches to Fischer-Tropsch diesel fuel, that's probably going to be its diesel fuel, it's probably not going to have one Fischer-Tropsch for fleets, you know, that know about it and a conventional diesel fuel for other diesel vehicles.

So it's not clear that that control is going to be as close, you know, as would be desirable, and wouldn't that problem also be avoided by blending the product.

MR. BRADFORD: I think, Ian, correct me if I'm wrong, I think the control is primarily around the maintenance.

So the fact that the vehicle would switch between Fischer-Tropsch fuel and occasionally fuel with a standard diesel, I don't see as being an issue. Ian?

MR. VIRRELS: Yeah, we just finished an inter-trial with CalTrans in the Sacramento area and we ran on pure 100 percent SMDS diesel for approximately a month and a half and found no problems at all. In fact, I spoke to the CEC only last Thursday. They said they still have no problems with leakage or anything like that and that was just a straight switch to a tank of 100 percent SMDS that we suppled them with. They do have a good vehicle maintenance.

We've also found, it's worth saying, that when nitrol seals are used, which are increasingly used in modern technology vehicles, we don't see the problems that some of the older seal types have. I know we have some data and I've been talking to Linda about sharing that as well, working a joint trial and there are some other people who we need to consider but we've got some new data on swelling, that we can potentially share.

MR. BROOKMAN: We'd sure like to see that data.

MR. GOODMAN: My point is that there may be people refueling with Fischer-Tropsch diesel fuel that don't even know about it at a public refueling station.

MR. BROOKMAN: Linda Bluestein.

MS. BLUESTEIN: Okay, actually this is Linda

Bluestein, DOE. I actually have two questions. First of all, you mentioned that additives are needed to blend into the fuel and I was just wondering if you were suggesting any limit in particular for those additives.

MR. BRADFORD: I think Ian could advise us as to what we would recommend. With regard to the DOE ruling, we don't see the additives as being crucial to fulfilling the energy security or emissions requirements and therefore, I'd say, well, just let the market get on and let suppliers define what additives that they should be advising their customers to use.

MR. VIRRELS: Just a quick one, I think the key is lubricity and we all know the Swedish Class I is being there as a lubricity additive with no problems. I know the specification in the U.S. is a bit of an issue at the moment in diesel. I don't see why that comes into this forum. It's more a fitness for purpose which the suppliers will sort with the OEMs and the people actually buying the fuel.

MS. BLUESTEIN: So are you saying that we shouldn't set a limit on additives?

MR. BRADFORD: I don't see that it's needed.

MS. BLUESTEIN: And then I guess the second question I had and this is a little bit outside the area of your presentation but if there's any discomfort in answering this, you can let me know but I guess I'm just particularly interested in Shell's interest in seeing this fuel designated as an EPAct alternative fuel, given that the scope of the market is really small. I mean, do you actually see opportunities if we designate this fuel as an EPAct fuel?

MR. BRADFORD: I think we see the designation being for us more of a symbolic recognition. This is a fuel that has value for the country with respect to emissions and energy security benefits and then looking to extract practical gain from it but the time our next generation of classes comes on stream.

MR. BROOKMAN: Marc Goodman.

MR. GOODMAN: A few. You made a number of references to data you've submitted to DOE by which I think you're referring to your DEER (phonetic) presentation that you provided the DOE.

MR. BRADFORD: That's correct, yes.

MR. GOODMAN: And that presents the results of some of this eco-toxicity data.

MR. BRADFORD: Yes, yes.

MR. GOODMAN: Obviously, it would be very useful to us to have the original data. Do you have that?

MR. BRADFORD: Yeah, sure.

MR. GOODMAN: The same goes for your -- the market -- the life cycle analysis would be expanded, systems expansion approach. If you could get authority to release that, that would be good.

MR. BRADFORD: Yeah, the life cycle I'll have to look at the authority to actually release that. It's not entirely within the control of my company. The consultant that did the study also has a say in that.

MR. GOODMAN: When you talk about there being no other way of utilizing the gas that would be used with Fischer-Tropsch diesel, can you qualify that? Aren't we talking about gas that doesn't have a particularly high monetary value as of 2002 with market conditions and current technologies but that some point down the road, I mean, we're talking about you know, all fossil fuels by definition are a resource and we have to have some concern that we're going to run out of them and they will become a lot scarcer as the years go by and we're really in no position to say that it will never be used for any other -- an official use that might involve a more efficient system of utilizing it.

MR. BRADFORD: It's very hard to say never to anything but if you look at some of these locations where there is lots of gas, the choice appears to be between gas to liquids or to leave that gas in the ground for 100 years by which time the world will probably have moved on from fossil fuels anyway.

MR. BROOKMAN: Additional questions?

MR. FREERKS: Bob Freerks from Syntroleum. I just wanted to point out that ASTM is addressing the fuel lubricity issues in D975 and so just specifying that a fuel meet 975 in the future will probably include a lubricity standard as well, so it should not really be an issue. And I agree that the market really should set the additive FREETS (phonetic) that are put into the fuel. That's a very reasonable way to handle that situation.

MR. BROOKMAN: And they're working on that specification for 975 now?

MR. FREERKS: Yeah.

MR. BROOKMAN: Okay, yes, please.

MR. COLVILLE: Steve Colville from Sasol Chevron. You mentioned about you thought the Department should think about cost efficiency and practicality coming in there. What did you really have in mind there by way of a measure? Was it something to do potentially with the AFBs and obviating the need, perhaps, to expensive conversion of vehicles to meet the regulations?

MR. BRADFORD: What I had in mind was something I saw presented by someone from the California Energy Commission awhile back and following that, Shell has actually commissioned the state to look at this as well, and it's defining what objectives you want to achieve, like replacement of petroleum or reduction of particulates or N0x, and then defining for different fuels what it actually cost you to achieve a one unit reduction.

Now, that, I think would be quite interesting data. I hope that we'll be in a position to have something like that appropriate for the U.S. market before the November 15th cutoff but otherwise, I have seen data of that nature presented by the

California Energy Commission that might well be of interest to you.

MR. BROOKMAN: Other questions, comments? Okay, then, thank you very much and our next presenter with Syntroleum is Steve Woodward.

MR. WOODWARD: Hello, good afternoon. My name is Steve Woodward. I am manager of fuel sales for Syntroleum Corporation. Syntroleum would like to thank Linda and the Office of Energy -- Efficiency Renewal Energy for the opportunity to speak here today and to have our fuel considered under this ruling. We also would like to thank the National Renewable Energy Lab and the Argonne National Lab for all the hard work they've done in assessing a tremendous amount of data and a really good job.

Syntroleum Corporation is one of the three companies that has petitioned the DOE requesting that Fischer-Tropsch diesel be designated as an alternative fuel under EPAct. Information regarding the petition that we supplied and submitted is on the docket as well as detailed responses to the questions that were proposed in the discussion paper for this workshop and also some additional information. And by the way, I'm not going to read what I wrote. I'm going to be a little bit extemporaneous.

But anyway, so anything that we have submitted, we have submitted in writing to the docket. Syntroleum does support the designation of non-domestic Fischer-Tropsch diesel as an alternative fuel under EPAct. And I might add that Stuart has covered quite a few of the points that I actually was going to speak to and some of the questions that have come from the audience have, but we believe that this is a logical step considering that domestic fuels have already been designated and it follows quite logically the foreign fuels should also be considered for all the reasons that we've mentioned and discussed here.

We believe that the designation of Fischer-Tropsch diesel as an alternative fuel would be a significant step to improving our national security as well as enhancing our environment. Some of my detailed comments have some information as to why those, we believe, are important statements. But we also believe that Fischer-Tropsch diesel is a logical choice for a fuel whose use will help U.S. accomplish the role in trying to reduce foreign imports. I think few people would disagree that the U.S. import status is not good.

In 1992 U.S. demand for crude and products was about 17 million barrels per day and of that amount we imported 8 million barrels a day or about 47 percent. Looking at EI data for the last six months, the U.S. demand for crude and petroleum products is now 19-1/2 million barrels per day. Of that amount, we import 11-1/2 million barrels a day or we're up to 58 percent. I think more importantly is that U.S. domestic production has actually declined from 9 million barrels a day to 1 million barrels a day. As a bit of a side, a lot of that decline has been in the Alaska North Slope production and there's actually some jeopardy that the pipeline, the Taps Pipeline, may not be able to continue flowing and that a Fischer-Tropsch plant located in Alaska could actually help improve the deliverability of U.S. oil to the lower 48 states.

Clearly there needs to be some means to turn this situation around. The Energy Information Agency is predicting by the year 2020 that we will be even more dependent on foreign imports up to 62 percent. Looking at the EPAct legislation and the results of the EPAct legislation, there clearly seems to be some need for a focus there. After the enactment of the legislation, there have been increases in the number of alternative fuel vehicles that have been used subject to that legislation. The number of vehicles has grown by seven percent per year since 1992.

But unfortunately the fuel used in those vehicles has only grown at about five percent per year. And those numbers don't seem too dramatic or too disturbing until you look at them a bit closer. If you take out LPG vehicles, which amount to about 60 percent of all of the alternative fuel vehicles, they -- LPG has only grown at about two percent per year in vehicle use and in fuel use. The use of compressed and liquified natural gases has had some very good successes. They have increased their use of vehicles by about 20 percent per year and their fuel has grown about 20 percent per year. And they account for about 24 percent of alternative fuel vehicles that are in use.

But the area that is of some concern are the alcohol fuel vehicles or the dual fuel vehicles. The number of vehicles in that category has increased 32 percent per year over the last 10 years but the fuel used in those vehicles has only increased about five percent per year. And the problem there is, is these are dual fueled vehicles and the availability of the fuel and the cost of the fuel is prompting those fleet owners to use the other fuel primarily gasoline in those vehicles. So although the goals of EPAct seem admirable, they just aren't working on a vehicle replacement basis.

What we would suggest is that EPAct needs a better fuel to accomplish its goals. It needs a fuel that is safe, that is reliable, and that is affordable and it also needs to stay within the guidelines of EPAct and what we're discussing today. It needs to meet those criteria of being substantially non-petroleum, being environmentally sound and energy security.

The ideal EPAct fuel must be safe to use. It must be safe for the people who use it and operate the equipment. It must be safe to the surrounding community, the people who are effected by the use of the vehicle in that community and it must be safe for the environment. And again, it must meet the criteria that we are actually establishing today for it.

An EPAct fuel must be reliable. It must not create problems for the fleet owner or any maintenance problems or any problems with operability. But I think more importantly, an EPAct fuel should be affordable. I think that any purposely designed fuel or fuel system is going to cost a little bit of money in order to deliver it to that market but it should be affordable and it should be accessible to the community that wants to use it. Affordable means that considering all the cost, the vehicle cost, the maintenance cost and the operation cost.

The challenge with EPAct fuels today is that they don't meet all of these requirements. Many alternative fuels offer substantially emission benefits but to have questionable safety or environmental impact. Other alternative fuels are very complicated to deliver, require modifications to the vehicles and to the infrastructure. And again, the biggest challenge is affordability.

We think that Fischer-Tropsch diesel meets all these criteria. We believe that it is a safe fuel, that it's a reliable fuel and certainly that it will be affordable. Fischer-Tropsch diesel offers reductions in the criteria pollutants. It has very little toxicity and is biodegradable. I think no one would argue in this room that there's nothing more reliable than a diesel engine that can go 800 to a million miles before it's taken out of service and diesel technology is quite simple even with advances in technology and it's easy to maintain and take care of.

Diesel fuel or Fischer-Tropsch diesel can be transported, stored and dispensed using conventional equipment without a lot of training or any expense. Even if you look at existing dispensing stations you can use existing equipment once it's cleaned, to dispense Fischer-Tropsch fuels. So that's just, I guess, a little bit of discussion as to why we believe that Fischer-Tropsch are important to EPAct over and above the criteria that they need to meet. But we believe they do meet those criteria. They are made or could be made form clean natural gas, which meets the first criteria of being substantially not petroleum.

We believe that they will contribute to U.S. security by providing a new diversified, non-petroleum source of energy for the U.S. and we believe they do offer emissions benefits.

I would like to now turn my attention to a couple of the questions that was posed by the DOE. I'm not going to attempt to answer all of the questions. As I said earlier, our comments are in the docket but the first question, should DOE define natural gas based fuels and particularly FT fuels? And yes, we agree that there should be some definition established. We believe that natural gas fuels should have some basic guidelines that specify the minimum methane content and that allows for other components in e feed stream, such as a few heavier hydrocarbons or inerts. I think someone else -- I believe Mossgas had some language to that effect as well.

We also, incidently agree with your assessment that Fischer-Tropsch diesel fuels made from coal or biomass do not need to be included with this consideration. I think one of the biggest questions that we might want to address is question 3 and that's whether DOE should set process energy limits in the determination of this rule and we say no, we don't believe that process limits should be placed on any manufacturer of Fischer-Tropsch fuels.

We believe that the issue of energy security is a much broader and encompassing issue of the production of these fuels. Moreover, we know of no precedence and that's not to say it's not there, we just don't know of any precedence that sets energy limits on other alternative fuels that are used or that are imported into the United States. That would include even the domestic fuels that are covered under the Appropriations Act. We don't know of any ruling that establishes energy use limits on conventional fuels that are being mandated by EPA to meet the 15 parts per million rules.

EPA didn't say that -- I think they've looked at the cost issues but I don't think anybody has looked at the energy use. So we believe that the bigger issue is covered in the DOE discussion paper as to the diversification of supply, the non-petroleum nature and the fact that a competing energy source would reduce energy reliance. And in our written comments we would direct your attention to a paper prepared by the Oak Ridge National Laboratory which is an assessment of energy and environmental issues related to the use of gas to liquid fuels and transportation. This was published in November of 1999 and it that paper the Oak Ridge National Laboratory basically said that the creation of a Fischer-Tropsch market would create energy security for the U.S. and they give a lot of reasons.

Question number 4, how should DOE balance its determinations about designated fuels, if fuels provides substantial benefits in some areas and perhaps neutral or slightly negative benefits in others. This speaks to the issue of emissions benefits weighed against greenhouse gas emissions. And we believe that those are not too comparative effects. Emissions criteria can be measured. There's been a lot of data presented today taking an automobile, taking the fuel and measuring the benefits of emission reductions.

Greenhouse gases on the other hand, are a subjective analysis or an assessment using certain assumptions as to efficiencies and production criteria and so one of them is an analysis or an assessment and the other is a measure to criteria. And we don't think that they should be directly balanced. We also would suggest that if you were to balance them, that although Michael has done an awful lot of work, he proposed several cases and we saw earlier today that depending on whether the Fischer-Tropsch plant is stand alone or if it has exporting electricity or gas or whether it's exporting steam, that you have different emissions benefits. We would suggest that some attempt be made to quantify the number of plants that will be this way or the number of plants would be that way and have an aggregate of what the production would be and we would suggest that if you were to do that, that even though the White Paper or the discussion paper discusses in in great detail how flare gas may not always be available. You can't really predicate a ruling on that. I would suggest that even a few years of a Fischer-Tropsch plant operating on flare gas or a few Fischer-Tropsch plants exporting steam or electricity would in balance create a neutral situation on greenhouse gases.

And so to answer the question specifically, we do not believe that the emissions should be measured against greenhouse gases. We believe there's enough criteria information to say that Fischer-Tropsch diesel produce sufficient environmental benefits without the consideration of greenhouse gases.

Question number 7, what parameters should be set for aromatic, cetane, sulfur and other standards? In our detailed comments, we list a list of specifications. We do believe standards should be set. We would suggest that the basis for those standards be ASTM D975. Bob just mentioned earlier that one of the concerns about additives, that being lubricity is, in fact, being addressed by the standards committee of ASTM and so I think that situation would take care of itself.

I apologize, I don't have a visual but we think that the maximum sulfur content should be one parts per million. We think the minimum cetane number should be 70. We believe the maximum aromatics content should be 500 parts per million by mass. That would answer another question should you worry about PAHs. At that level you don't really have to worry about PAH. We believe that the oxygen content should be 100 parts per million or that would be .01 percent by volume. That would equate to an oxygenate concentration of 1,000 parts per million by mass or .1 volume percent.

Question 11, what is Fischer-Tropsch characteristically sufficient unique to justify the inclusion of special additives? No, we do recognize that Fischer-Tropsch's fuels have a lubricity issue which I commented on earlier we think will be handled by ASTM D975. We think and we agree with Shell that the issue of additives should be between the supplier and the consumer and certainly anyone who wishes to manufacture a fuel that is to be consumed will pay attention to the needs of that fuel.

We believe that the issue of seal swell is largely an issue of older vehicles used in prior tests. Information was presented today about Shell work in California and having no problems and also the Swedish effort, the ultra-clean fuels.

So in closing, I would like to thank that DOE to have the opportunity to speak here today. Again, we support the designation of Fischer-Tropsch diesels as alternative fuels under EPAct and I'd be happy to address any questions you might have.

MR. BROOKMAN: Questions or comments?

MR. GOODMAN: Can you tell us how did you arrive at these specifications that you're proposing which are obviously a bit more stricter than some of the other people?

MR. WOODWARD: We arrived at these specifications upon close examination of the benefits of the fuel and the fact that we believe that the almost total absence of aromatics is what is contributing to a lot of the emissions benefits. We believe that most manufacturers who purvey this or practice this technology have it in their ability to meet those specifications and basically we believe why mess around. If you want to have a clean fuel, let's have a clean fuel.

MR. GOODMAN: But you're not saying that anything less than those would fail some threshold of substantial --

MR. WOODWARD: I'm saying that this is Syntroleum's suggestion as to the fuel specifications and certainly we will continue the discussion as to what the final specifications are.

MR. BROOKMAN: Linda?

MS. BLUESTEIN: Linda Bluestein, DOE. Thanks, Steve, for coming here and giving this presentation. I wanted to ask you a question that was sort of interesting to hear abrogating the industry into a whole and looking at it and you know, the -- to, you know, I guess figure out where we are on GHG emissions and if we had some really clean plants the whole industry benefits from that, but is that -- I guess I'm posing this question to you. If you invested and built a plant that was cleaner than the others, would you not want to have the benefit of being able to be certified, for instance, to sell and EPAct market versus a dirtier plant?

MR. WOODWARD: No, and don't mistake my comment. I do not -- I think one of your questions was should Fischer-Tropsch plants be abrogated in some sort of basis and if your portfolio of plants has certain greenhouse limits, then you qualify. I believe that no greenhouse gas limits should be placed on any Fischer-Tropsch plant. Moreover, I don't believe that any energy production limits should be placed on these plants. I believe the energy production issue is a very minor contribution to the issue of energy security. So I just think it's not a relevant point.

At the risk of perhaps saying the wrong thing, any energy that will be consumed will be offshore. It won't be on the U.S. because all of these are going to be imported products anyway. But what I did mean by the greenhouse gas comment is that if one is going to hold up some greenhouse gas yardstick, then I don't think one should take one Fischer-Tropsch plant and say a stand-alone plant should be compared against one replacement or not replacement but one fuel that is displaced, i.e., clean diesel and saying these two criteria are all it takes for me to judge.

I'm saying that you should take -- if you have to do a greenhouse gas analysis, that then you should take the -- or you should consider that some number of plants will be produced that are stand-alone. Some number of plants will be produced that export steam and electricity. Most of our projects that we have on the books have plants producing steam and electricity. Some plants will be produced from flare gas. For how long, I don't know; for how many I don't know but the fact is you didn't even consider it. You just said, here's Fischer-Tropsch stand-alone, here's conventional, let's make a comparison. One is more than the other. What are we to do about it? I'm saying that they're too close to call. I think Stuart and Shell have indicated the same thing.

MR. BROOKMAN: Michael Wang.

MR. WANG: Steve, thanks for your thought and information. If I understand correctly, your reasoning on greenhouse gas emissions is because the efficiencies is the subject, if the greenhouse gas emission results are subject because of that we should abandon greenhouse gas emissions for consideration of this rule making.

Let me add my perspective to this. I think especially for those of you who use Fischer-Tropsch diesel design and technology, when I see the efficiencies numbers you report, I think I have some confidence on the numbers you report and you are treated them as process in your assessments when you design a plant and, of course, you recognize there are uncertainties in an actual plant from your engineering design. So I would not say efficiencies are subject. I would say efficiencies, I base a theory assessment but with uncertainties in your -- taken into account. With that, we still do some assessment of greenhouse gas emissions we see -- with uncertainty in mind, we see an effect by the different options but the different fuels. So that's where I see it.

And furthermore, if we do see there is a potential to increasing greenhouse gas emissions we say in this room a process to have some safeguard that you have some safeguard to make sure you will have increase but we're not going to have (undiscernible) increase at all.

MR. WOODWARD: Well, I think that if -- and I agree with your comment that the efficiencies that were presented were not subjective. They were reasonably detailed estimates based on engineering studies. My comment as to the subjectivity is you had the opportunity to -- for example, NREL took an awful lot of time to talk about how statistically insignificant the data was that was presented on the tens and twenties of tests that were produced by various reporters as to the analytical effort to determine the emission criteria.

You had no attempt to make a statistical prediction as to what degree of flare gas or what degree of stand-alone gas or what degree of exporting electricity or steam. Basically, you have this real rigorous approach on one hand and then you have the other approach where you have all the basic data to do it, but you just said, "Here is this piece and here is this piece. If we take one of these guys out of this piece and one of these guys out of this piece and compare them, we get some sort of answer".

And I also agree that if the numbers were drastically different, if the technology to produce Fischer-Tropsch diesel were four times the greenhouse gas emissions, then you have a point, but the fact is they're very close. You really can't at this point in time, predict what plants will be built, what contribution to the Fischer-Tropsch diesel market those plants will do. You can't even predict what technology will do tomorrow. Right now, we are on the cusp of Fischer-Tropsch's diesel technology.

In other two years, the efficiencies that we are reporting have a good chance of being lower. We are not talking -- we haven't discussed at all about C02 sequestration. Many of the plants will be located in areas where the producer actually will require the tail gas stream for reservoir maintenance in this field and you'll have CO2 sequestration opportunities. So I'm just saying is, basically, I think the decision should be greenhouse gases are too close to call. Let's look at the determination on emission benefits.

MR. BROOKMAN: Marc Goodman.

MR. GOODMAN: You agree that that is conventional regulatory -- environmental regulatory practice, you know, in most other fields, that you regulate the plant as specific sources of emissions whereas you look at mobile sources, fleet vehicles, you know, on the probablistic.

MR. WOODWARD: And where those plants are located that you're regulating.

MR. GOODMAN: Well, for the most part we don't have regulation greenhouse gases yet but you know, in the general sense --

MR. WOODWARD: All right, but the plants you're speaking of where would they be located?

MR. GOODMAN: I'm talking about regulation within the U.S.

MR. WOODWARD: All right, these plants would be located in external areas to the U.S. and so greenhouse gases really aren't a U.S. issue for regulatory purposes.

MR. GOODMAN: Except that greenhouse gases are an issue for global warming, and it's not particularly important where they're located.

MR. WOODWARD: Well, that's true.

MR. GOODMAN: You talk about, you know, if you eliminate some flaring, gas would have been a flare for a little while, from what I understand you're talking about the small mobile type plants that might take some associated gas that is otherwise -- going to be otherwise disposed of but you will be able to eliminate the flaring earlier than you would through some other means and so you would bring in a mobile Fischer-Tropsch plant and use it until you could bring some --

MR. WOODWARD: No, what I'm saying is that everyone in this room that has this technology are looking at projects that have a variety of sources of gas. Some of those gases are flared gas. Some of them are actually vented gas and someone made the comment earlier that, yes, in most areas of the world, it's against the law to flare or to vent. But it has been against the law for several years and it still continues to happen.

I'm saying there will be Fischer-Tropsch plants built on gas that is supplied from arenas that are flaring and venting. There will be Fischer-Tropsch plants that will be built that will be stand-alone and there will be Fischer-Tropsch plants that will be built that will have exports of steam and power. And that you just cannot categorize Fischer-Tropsch plants with one greenhouse gas emission. You need to look at the whole array and if you would look at the chart that Michael put up earlier, and if you just glance along the blue lines and the yellow lines, you'll see that they converge and they overlap and that there is a great deal of overlap there.

And essentially, I'm not really going to spend much more time on this. If anyone wants to quiz me on greenhouse gases, we can do so later but our position is that there will be a variety of plants built. Those plants will contribute a little more or a little less to greenhouse gas emissions and that the overall assessment is that it's probably a neutral decision as far as this ruling is concerned.

MR. BROOKMAN: One final question.

MR. GOODMAN: On the process energy limits efficiency, I mean, you're aware, of course, that DOE spends a great deal of money on efficiency enhancements of all different sorts. The idea that because this is gas, it's not oil, it's offshore, we don't have to care about efficiency at all, that's basically your position.

MR. WOODWARD: I'm saying that the difference in efficiency of a few percent has very little volumetric impact as to the use of Fischer-Tropsch diesel as an alternative fuel. Some discussion has taken place as to what Fischer-Tropsch diesel could be actually used in once it was declared an alternative fuel. My vision would be that alternative fuel vehicles with diesel engines would be certified to run this fuel and they would go into the fleets that they're intended to be used in.

That being the case, that light duty vehicle could replace some other vehicle that's currently out there and the energy efficiency of diesel being 40 percent greater than gasoline, would create substantial energy benefits just because it's available and it could be used. And those benefits would be far in excess of some limits you place on the production efficiency.

MR. GOODMAN: The Oak Ridge study that you cited from, you are aware at one point in its discussion it discusses the differences in reserve production ratios between petroleum and gas and the trend over the years. And then it suggests that based on these differences in reserve production ratios, Fischer-Tropsch at about 60 percent efficiency, 60 percent differential and efficiency compared to petroleum production that that might be an appropriate threshold for determining if there were energy security benefits.

MR. WOODWARD: I didn't use or cite the Oak Ridge study for that purpose. I cited it for the energy security purposes and I believe the overwhelming conclusion of that report was that the formulation of the Fischer-Tropsch industry, no matter what country it resided in, would provide substantial energy security for the U.S.

MR. BROOKMAN: Additional questions, comments at this point? Thank you.

MR. WOODWARD: Thank you.

MR. BROOKMAN: Thank you very much. Thanks to all of our presenters. Thank you very much. It's 2:35, probably about time to have a little break. And when we return -- I think we've already begun to address the specific data questions that I read just prior to the lunch break. We want to take a peek of those at the break and we're going to want to go through them rapidly. Let's see if we can start up at 10 minutes till 3:00. We'll start back up at that time.

(A brief recess was taken.)

MR. BROOKMAN: Okay. We should be done at 4:30. Okay. The next time on the agenda is to deal with a series of rather specific questions the first of which or several relate to emissions data and you can see them up here on the board and let's just take them one by one and this is DOE's effort to really see if there's any data out there that they haven't captured yet. Several of you, in your presentations and earlier comments, referenced data that you might be able to get through the Department.

We're asking if any additional FTD emissions data including a wide arrange of vehicle engine types, conditions, ages and mileages, dates of repair, et cetera, is any of that available? I'm just going to take notes up here as we're going along. And I'm wondering if anybody has any additional sources that we haven't mentioned already.

I'm guessing that Argonne and NREL did a pretty thorough search. You referenced a few that you're going to have to check on, right? Cyril, go ahead.

MR. KNOTTENBELT: Yeah, we'll supply the Concawe data from 1999.

MR. BROOKMAN: Concawe?

MR. KNOTTENBELT: Concawe, C-o-n-c-a-w-e. It's -- the paper was released in June `99, so it could probably all be pre-'98 vehicles that were used in the trial but it was an extensive paper.

MR. BROOKMAN: Thank you. Are there other data sources, particularly post-'98, I think was one of the specific requests.

MR. VIRRELS: Can I add something?

MR. BROOKMAN: Ian.

MR. VIRRELS: Sorry, yes, Ian Virrels, Shell. We've got some data that CC have conducted with another partner and they're just finishing up the work. My understanding is that CC will submit that by the 15th November deadline directly to DOE and there's some data on `99 and 2001 model year engines, CalTrans fleet tested in California.

MR. BROOKMAN: Okay, thank you very much. Other data sources that people know about that they are able to send forward that haven't already been referenced? Yes, please.

MR. WOODWARD: Yes, Steve Woodward with Syntroleum. Are you looking at data that you had with the original submission because we've submitted with our comments more resources, so I'm not sure --

MR. BROOKMAN: You cited in what you've submitted already additional sources.

MR. WOODWARD: Yes, yes, we did.

MR. BROOKMAN: And you marked them as responding to that.

MR. GOODMAN: That's something you just submitted in the last few days, right?

MR. WOODWARD: By the 10th, whenever the deadline was. We cited, there were several SAE reports and there are actually at the next SAE conference there are three papers to be presented on Fischer-Tropsch diesels that might have some pertinent information in them as well.

MR. BROOKMAN: Okay, thank you. Others?

MR. SOWARDS: Yeah, this is David Sowards with Sentroleum. DOD has done a significant amount of testing with Fischer-Tropsch diesel and in cooperation with Southwest Research and we can certainly provide or provide links to accessing that information.

MR. BROOKMAN: And what was the source again, David?

MR. SOWARDS: Department of Defense, specifically TACOM, T-A-C-O-M.

MR. BROOKMAN: Thank you very much. Okay, let me ask specifically the second bullet there, data on post-'98 engines including emissions equipped with -- pardon me, engines equipped with emissions controls. Perhaps some of what you're referring to has post-'98 data in it. Yes. Are there any additional sources that specifically target that?

MR. McCORMICK: Bob McCormick, by emission controls, I believe we mean catalyst systems.

MR. BROOKMAN: Catalyst systems, okay. Dave?

MR. SOWARDS: Yeah, David Sowards, with Syntroleum. I'd just ask Bob which -- are we talking about N0x or are we talking about particular matter? Okay, well, there's a significant amount of work that's out there regarding ultra-low sulfur diesel and regenerative matter traps and NREL itself has done a significant amount of work with regards to Fischer-Tropsch diesel and N0x absorption. So there is a lot of information out there to populate.

MR. BROOKMAN: I am looking over, Robert, and do you feel like you have access to that information?

MR. McCORMICK: I'm aware of some data. I'm aware of some studies, NREL studies done on seamless cylinder prototype engine systems but I'm not sure are close enough to real world engines to really draw any conclusions from it.

MR. SOWARDS: This was a commercial power stroke engine. So I would be glad to direct you to that data.

MR. BROOKMAN: That would be helpful. Could you send an e-mail?

MR. SOWARDS: Yeah. Okay. Excellent. Any other information on post-'98 before I move onto the next bullet, which is test data that included detailed fuel composition data for tests in control fuels which I'm calling number 3? These are rather specific requests. Ian, go ahead.

MR. VIRRELS: This is Ian Virrels from Shell. I've spoken to NREL and we may be able to supply some more detailed compositional data in addition to what we've already supplied. Those data were already included in the NREL research paper presented here but we may be able to supply some more.

A more general comment, I'm going to do another tour of all of our literature and check that everything was covered and pop it to NREL so you have our complete set of published literature.

MR. BROOKMAN: Excellent, thanks very much. Thank you. Okay. Yes.

MR. WOODWARD: Steve Woodward from Syntroleum. In preparation for some other work, I went to one of the DOE websites and in the 2000 progress report and the 2001 progress report, under the program fuels for advanced CIDI engines and fuel cells, there appears to be quite a bit of research going on, research projects going on. I would assume that you have access to most of that data and I don't need to resubmit it or present you with that.

MR. McCORMICK: I believe that data is included in our analysis. It was also published in other places and so it might not be cited exactly as you've got it there.

MR. WOODWARD: Because here's one evaluation of advanced petroleum based fuels in a Mercedes Class C, CIDI engine and so, I mean, apparently -- and this is a 2000 report, so apparently there's information out there, but, I mean, perhaps we can individually compare what you actually have versus what I have perceived to be out there, I'd be happy to.

MR. BROOKMAN: Okay, yes, Marc Goodman.

MR. GOODMAN: Yes, and on the side of -- obviously, what we'd like most would be test data on Fischer-Tropsch diesel test fuels versus conventional control fuels and detailed composition data on that. Absent the, if there's data on various (tape failure) detailed composition data, that would help us as well.

MR. BROOKMAN: And the fourth bullet point on this slide is test data comparing FTD to -- yes.

MR. SOWARDS: David Sowards, Syntroleum. I have a follow-up question to Mr. Goodman. When we talk about detailed compositional data, could you be a little bit more specific? We've tried to be good stewards in supplying a significant amount of detail with regards to the fuel. If there's anything that we've left off, could you be a little bit more specific, please?

MR. GOODMAN: Well, we'd like to see the relative proportions of normal paraffins to -- you know, to iso-paraffins, cyclo-paraffins, hydrogen content data, installation data.

MR. BROOKMAN: Other specific compositional?

MR. GOODMAN: I mean, if there is speciated emissions data, that would be even better. Of course, we don't expect a lot of that.

MR. BROOKMAN: Someone wishes to respond. Yes, please.

MR. FREERKS: We do have most of our --

MR. BROOKMAN: I'm sorry, I've forgotten your name.

MR. FREERKS: Oh, I'm Bob Freerks.

MR. BROOKMAN: Thank you, Bob.

MR. FREERKS: We do have most of our speciated emissions data in our emissions reports that Southwest Research generated. The only piece of data that we don't have in there in terms of fuel properties is the iso-normal ratio, which is about 20 to 25 percent iso, 75 percent roughly normals.

MR. GOODMAN: I think those studies, speciated, the principal toxics. You know, it would be great if we had a complete emission speciation.

MR. FREERKS: Yeah, we had all the unregulated emissions, the aldehydes, the aromatics. Every single speciated emissions was measured and it is in the report.

MR. GOODMAN: Do you have those, Bob?

MR. McCORMICK: That was submitted with the original petition.

MR. WOODWARD: We submitted it. No, it was one engine on three different fuels, diesel Series 60.

MR. FREERKS: We did the Cummins, 5.9 --

MR. WOODWARD: Oh, yes, it was three -- excuse me, it was three engines on three fuels or four fuels.

MR. FREERKS: Yeah, we had the Cummins 5.9, as an engine on a dynamometer, essentially the identical engine in a Dodge Ram pickup truck, and a VW TDR and we ran it on D2, R, Swedish and Fischer-Tropsch diesel fuel.

MR. BROOKMAN: Excellent and you're nodding your head. You've got -- you have access to this data. Thank you. Okay, thank you. That confirmation is useful.

Also we're looking for test data comparing FTD to ULSD. Additional data on FTD fuel economy and differential to conventional diesel, that would be -- that's included in that data. This would be number 5. Additional sources for that top bullet there? Did I see a hand go up? Yes, please.

MR. McNUTT: Barry McNutt, DOE. Going back to just your very last one you went by, ULSD is not a spec'd fuel, so you want to be very careful about it.

MR. BROOKMAN: Thank you.

MR. McNUTT: We in fact, don't know what it's characteristics are going to be other than it's going to meet a certain sulfur limit and it may take on some of the characteristics of a reformulated diesel fuel depending on whether it's made one way or another. So I'm suspicious of the argument that we know what ULSD is.

MR. BROOKMAN: Thanks for that clarification. That's very helpful. Back to fuel economy and differential to conventional diesel, any additional sources on that? That would be the top bullet on this page. Yes.

MR. VIRRELS: Yeah, we at Shell have got some new data we might be able to share, so I'll forward that as appropriate.

MR. BROOKMAN: Okay.

MR. WOODWARD: Steve Woodward with Syntroleum. There is a great deal of work going on in California with the California Energy Commission and the California Air Resource Board and I think Shell is even participating in those tests, that are ongoing but soon to be concluded and should have some fairly significant data that address most of these questions about emissions and performance and the like.

MS. BLUESTEIN: Linda Bluestein, DOE. Steve, is that the same as what they've brought up before, the same CEC data set?

MR. WOODWARD: I don't know.

MR. BROOKMAN: Ian is shaking his head no.

MR. VIRRELS: Yeah, it's not only Syntroleum. There's been another player.

MR. BROOKMAN: And Steve, do you know where that's going to be over?

MR. WOODWARD: No, I don't. I just know that in speaking with people who are conducting that work, they are draft reports being prepared and I'm not sure on the timeliness, when that data might be released. But it would be fairly germane to the issues that we are trying to address.

MR. GOODMAN: We know who those people are.

MR. SKLEDAR: Just a real quick comment.

MR. BROOKMAN: Your name again for the record.

MR. SKLEDAR: Yeah, Gregg Skledar. I believe what you're referring to is the South Coast Air Quality Management District combined with maybe it was -- there's three parties involved and I think Shell might have been the fuel supplier, I'm not sure but there is a study that's going on in Southern California looking at FT diesel comparing it to conventional fuels and there was -- I'm trying to remember what they called the request last year that went in for that because I know we were one of the people offering fuel into that. But I think it was Shell that was probably the supplier in the end.

MR. BROOKMAN: Okay, thanks very much. We're now, I think, on the second bullet on this page, data on power obtained with FTD and/or low density diesel fuels, any additional that we haven't already captured in this listing? Yes, please.

MR. SMITH: Doug Smith of CONOCO Phillips. We've been participating in the DOE program and we looked at a 5.9

liter engine and we're gathering data or will be gathering data on a lot of these specific issues but the data won't be available for some time. I guess it will be probably later next year but just to let you know.

MR. BROOKMAN: So is this going to be almost a year.

MR. SMITH: It will be.

MR. BROOKMAN: Okay, okay, I'm not sure that helps at this point. Probably not. You heard him okay?

THE REPORTER: No.

MR. BROOKMAN: Would you say your name again loud for the --

THE REPORTER: That microphone is not working.

MR. SMITH: Doug Smith with CONOCO Phillips.

MR. BROOKMAN: Doug Smith with CONOCO Phillips. Thanks very much, Doug.

I guess that one is not working, we'll not use that any more. So durability emissions data, can someone describe that that is, that specifically you're looking for?

MR. McCORMICK: Yes, this is Bob McCormick. Well, as an example, when a engine is certified for emissions, it has to meet the emissions standard after -- essentially after 1,000 hours after operation on the engine durability. And that's using certification diesel fuel. Because of the significantly different properties of Fischer-Tropsch diesel with respect to lubricity and elastomer compatibility, it seems a reasonable question to ask how the engines hold up over 1,000 hour durability study for an emissions standard.

Alternatively, there could be vehicle testing data for vehicles early in their life running on FT and then after some defined period of time, compared to emission diesel control --

MR. BROOKMAN: Yeah, the --

MR. McCORMICK: -- data of that nature is what we're looking for.

MR. BROOKMAN: Bob?

MR. FREERKS: Bob Freerks from Syntroleum. One of the things that you're getting at is what impacts would the fuel have on the overall system is what I think your whole question is about. And we do know several things about the fuel. One, it is a subset of existing diesel fuel, though the differences are not all that great, you know. The paraffins are in existing diesel fuel and so we're just basically looking at a smaller fraction of existing diesel.

We do know that because you've eliminated the aromatics and other reactive components, that the fuel is more stable. And one way that you can look at that is in the injector deposit data that at least we have generated, that showed that this fuel is less prone to form deposits on injectors so that should help the overall emissions durability. Now, we haven't run a fuel for 1,000 hours yet. But there is a demonstration program that we will be applying the fuel for but that's going to be another year and half or so before we get data out of that.

But I think there's enough ancillary evidence to point to the fact that this fuel is not going to have any hard part durability issues. Soft parts, like seals, it probably will have an impact on older vehicles but newer vehicles have much more resilient seals and we're working with like Parker Seal and others to determine any impact on seals of this type of fuel. And their view is that these types of dry fuels already exist and they haven't had any real issues, so we'll have to try and see if we can get some more data together from say some of the seal manufacturers to support these statements. But I don't think that the seals are going to be a major impact, especially on newer vehicles.

Older vehicles that will be a different problem but hey, their seals are getting old anyway.

MR. BROOKMAN: Thank you. Thanks very much. Other comments on durability issues. We've already covered today quite a bit on cold flow performance with very high n-paraffin fuels. Additional data that's available on that bullet. That would be E. Bob?

MR. FREERKS: We do have a little bit of data on the impact of flow improvers on fuel and on isomerizing of fuel to meet low flow properties. So I think we've already stated that we've made fuel that has minus 55 freeze point, basically, it's a jet fuel and we have done some testing with flow improvers to show that they do behave the same in our fuel as they would in a conventional diesel fuel and so you can take a high clog point piece of fuel, put in normal flow improvers and lower the clog freeze point of any type fuel.

MR. BROOKMAN: Okay.

MR. FREERKS: So we can provide some of that.

MR. BROOKMAN: Other data on cold flow issues? I'm moving to the last one on this page. Did a compatibility of near zero aromatic fuels -- you've referenced that already. I'm talking about the seals. Does that fit with other people's experience and is there any other specific data that might be sent to the Department?

MR. KNOTTENBELT: Yeah, we've committed.

MR. BROOKMAN: Okay, Cyril will as well. You already referenced speciated emissions data once, right? Health and welfare effects data. Have we referred to that much in this workshop? Not much. Are there data sources that relate to health and welfare effects?

MR. SOWARDS: David Sowards with Syntroleum. EPA has done some I guess moratory analysis of the effects of low sulfur diesel fuels in the marketplace. So I would put forth as a source for some of the information as the Environmental Protection Agency.

MR. BROOKMAN: Okay.

MR. FREERKS: Bob Freerks, Syntroleum. There is a EPA, what do I want to call it, structure activity relationship program that can be used by someone who's a little bit well versed in biotoxcity to look at almost all the impacts of paraffinic fuels versus aromatic containing fuels on the environment. These programs are in the EPA website. They can be downloaded and you can look at biodegradation, toxicity to various aquatic and animal life. There's given areas toxicity values for all these different hydrocarbons and so that can be modeled as well as measured. We have done some animal and aquatic testing on our fuel to show that they have much lower toxicity than conventional diesel fuels and I believe we were either going to submit or did submit that data.

MR. WOODWARD: Yes, Steve Woodward with Syntroleum. In response to DOE question number 9, we submitted more recent and more expansive test data on toxicity, aquatic toxicity and biodegradability and also I found in DOE's Office of Transportation Technologies a detailed report on the chemical characterization of toxicology relevant compounds from diesel emissions and I submitted that paper to the docket which seemed to be a quite exhaustive study of the relative effects of toxicity of Fischer-Tropsch diesel compared to an ultra-low sulfur diesel, conventional diesel and the diesel fuel containing MME.

MR. BROOKMAN: Thank you.

MR. WOODWARD: That was submitted by October 10th. I actually have a copy of that.

MR. McCORMICK: (Inaudible)

MR. BROOKMAN: That's Robert McCormick speaking. Okay, so you know it's there in the record now.

MR. WOODWARD: Well, how about me just handing you a copy of it?

MR. McCORMICK: That would be fine.

MR. WOODWARD: If I can find it, which I can.

MR. BROOKMAN: Ian.

MR. VIRRELS: Ian Virrels, Shell. We've already agreed we'll share the full toxicity biodegradability data with you. On the health effects, the DOE conference in San Diego and all of us know there was a lot of new data there. I think you would like to have a look at that. You may have already considered it.

MR. GOODMAN: Yeah, if you could get that to us. And you're talking about getting us the original data, the original --

MR. VIRRELS: Oh, sorry, it wasn't data that Shell presented. It was from experts on health effects.

MR. GOODMAN: But you have a copy of it.

MR. VIRRELS: Yeah, it's on the DOE website.

MR. BROOKMAN: Okay, okay. And then the final bullet on this page, biodegradability, ecotoxcity data, I think both Cyril and Stuart referred to that in their presentations and I'm wondering if there's any additional data to be gotten on this biodegradability, ecotoxicity repairability, right, and that being the emphasis. Go ahead, Marc.

MR. GOODMAN: When you're referring us to the DOE website, can you e-mail us specifically where these things are on the EPA website and the DOE website?

MR. VIRRELS: Okay, sure.

MR. BROOKMAN: That would be helpful, okay, thank you. Are there any additional data sources related to biodegradability and ecotoxicity data?

MR. FREERKS: Bob Freerks from Syntroleum. The EPA website, and I'll make sure that you get a pointer to that, will give you an awful lot of ability to look at the biodegradability and ecotoxicity of various typed of hydrocarbons, whether they're n-paraffins, branch paraffins or aromatics, you plug those types of structures in. You have to be a chemist to be able to figure it out.

There's a very specific way to input the data but if you have questions, you can give me a call.

MR. McCORMICK: This is Bob McCormick. I believe you're referring to what EPA calls the EPI sweep --

MR. FREERKS: Yeah.

MR. McCORMICK: -- which we have and use that you have to apply that to pure compounds. I'm sure we could compare normal cetane versus naphthalene (phonetic) or whatever but it's not immediately clear how you (inaudible).

MR. FREERKS: Yeah, it is not a leap of faith but you have to make some interpretation of the toxicology data and what I think the EPA is going to do is look at a composite of all the results and weight average them across, say the n-paraffins and iso-paraffins and cyclics and aromatics in a fuel to give an overall value for a given fuel. We may need to actually talk with EPA about how they imply it to a mixture versus pure compounds to get a true interpretation of those datas but yeah, it is not straightforward to use that. It takes a much more sophisticated analysis to get some, you know, definitive results but for pointers, I think it's pretty good that you can say that normal paraffins are going to be more biodegradable and less toxic than iso-paraffins and iso-paraffins are better than cyclics and cyclics are better than aromatics. So just in a general trend, you're going to get that kind of result in the data and that's probably good enough.

There is other toxicology data on the Canadian website that they've looked at conventional diesel fuels and they give all kinds of environmental data on those fuels and I can point you to that website. I don't have it handy, but it's Environment Canada and they look at Canadian diesel fuels and done a lot of biodegradability and toxicology testing on them and that would just set a baseline for what those fuels look like and then we've done Miseting (phonetic) and other toxicology tests on our fuels for comparison.

MR. BROOKMAN: Okay, Cyril, do you have a comment?

MR. KNOTTENBELT: Yes, I think that to use some of the models and specific chemical structures as was mentioned gives an indication but you've got to realize that biodegradability and toxicity are going in opposite directions. If a molecule is biodegradable, it's probably not biologically or it would be biologically available and hence, it would be -- it may be more toxic to an organism. So probably the best is -- and then also you've got the vulnerability depending on channeling that would play a factor here, so the best would be to adopt one of those two tests that we suggested, the electro-caris (phonetic) or the masodoptus, (phonetic) the Mesting test and agree to use these tests across all the fuels because otherwise you're going to come to some people using depnia (phonetic) as an indicator for toxicity, other people will use mice and you won't be able to make anything of the data. So somewhere along the line a poll is going to have to be made on the standard based organism.

MR. BROOKMAN: Thank you. Additional comments on biodegradability or eco-toxicity data? We've covered that. I'd like to shift gears. Yes?

MR. WANG: I'd like to take a comment, that's

Fischer-Tropsch diesel energy and carbon efficiency. In our study we --

MR. BROOKMAN: We need to find a way -- you're going to have to repeat the question. For some reason we're not getting you on --

THE REPORTER: I'm not hearing you.

MR. BROOKMAN: He's not picking you up.

MR. WANG: Okay, I'd like to --

MR. BROOKMAN: There you go, okay.

MR. WANG: I'd like to take this opportunity to ask more data on energy and carbon efficiency of Fischer-Tropsch diesel plant. In our analysis we did as we present today, we remarked on the three petitioners' energy efficiency that is submitted in October 2001. So if you have now data to update what you submitted a year ago, we'd like to see your new data. And besides the three petitioners for sure what we have is published probably last year, so this is what we have from Shell in public domain. And for Sasol, Chevron Texaco and in public domain which we can see your work. And I'd like to see if you can put your efficiency data in public domain and then of course, the project with CONOCO Phillips and I wonder if for that project you have efficiency numbers to submit so we can see it as well.

MR. BROOKMAN: Okay, final comments before I shift to the next set of questions. So the first question that I'd like to see us address is this one, an approach to designing

Section 301(2) designation FTD versus any diesel fuel made from natural gas. And we've heard pretty much throughout the day today about an FTD designation. Marc, do you want to follow on that?

MR. GOODMAN: Yeah, we've heard a number of suggested language which we can work with and look at. The question here, is there any real difference between those two formulations? Is there any likelihood at all that somebody would come up with a process for making diesel fuel from natural gas through some process other than Fischer-Tropsch diesel?

MR. WOODWARD: Marc, Steve Woodward, I'm not quite sure I understand the question.

MR. BROOKMAN: And that tracks what I was thinking because until Marc just said it then, I wasn't quite sure what the distinction was. Your question is, is there any significant difference?

MR. GOODMAN: Difference between those two terminologies, yes. In other words, should the DOE regulation use the term Fischer-Tropsch diesel and assume that either the people will know what that is or we would have to define that significantly. Or if we simply said any diesel fuel made from natural gas, would that be sufficient?

MR. WOODWARD: Syntroleum's opinion would be that it should be Fischer-Tropsch diesel derived from natural gas, that they should be mutually linked.

MR. SOWARDS: David Sowards, Syntroleum. I think when Linda made her opening comments it was very succinct as far as the process and we would be amenable to something of that line as far as the designation for Fischer-Tropsch diesel.

MR. BROOKMAN: Well, I want to make sure at this time since we're dealing with rather broad questions that anybody that has a different perspective, we hear from them. Now is the time to speak up because the department is here to hear these divergent points of view potentially. Yes.

MR. FREERKS: Bob Freerks from Syntroleum. You, I think, can call DME a natural gas derived gas fuel, too and I don't think we want to include that.

MR. BROOKMAN: So what do you suggest as a way out of that?

MR. FREERKS: I would say a linear -- or a paraffinic hydrocarbon fuel derived from natural gas would be a fairly clean way to do it.

MR. WOODWARD: Well, the statement was -- I hate to disagree with you here but I think a designation of Fischer-Tropsch diesel which identifies the process, identifies the product, and as Linda stated, made from natural gas including menthane (phonetic) gas, having the properties that we will then designated to have on the specifications, i.e. thinning ASTM D-975 and then whatever properties are associated to the sulfur, aromatics and cetane.

MR. BROOKMAN: Okay. Do you wish to follow up on that, Bob? That works for you.

MR. McCORMICK: That will work for me.

MR. BROOKMAN: Okay.

MS. BLUESTEIN: Linda Bluestein, DOE. Feel free to submit comments for the record on this. I think we should go to the next one.

MR. BROOKMAN: Okay, here we go. The next one, you can see there can and should be environmental detriments of one type, greenhouse gases, for example, be based on environmental benefits of a different type, it's a balancing question. So some of you addressed that in your comments. Other comments that you'd like to add at this time?

MR. SOWARDS: David Sowards with Syntroleum and I wanted to add to one of the comments that was made earlier as far as modular plants or even floating plants to take advantage of some of this gas that's being flared and maybe flared for a short time and the idea is that these plants could be mobile. Syntroleum is doing a significant amount of work with the DOD as well as commercial efforts for floating plants as well as these smaller modular plants. So it's quite conceivable that from a greenhouse gas perspective will be I guess, farming this gas that would be ordinarily flared or vented and sort of in a hummingbird fashion going from one flared spot to another.

As a matter of fact, we have a marketing term in tooling with respect to these plants. It's called flare buster.

MR. BROOKMAN: Okay, thank you. Other comments on this one, the balancing of detriments versus benefits?

MS. TUCKER: Yes, Sherry Tucker. I have a comment. And this falls on Sentroleum's earlier comment which I thought raised a very interesting and perhaps -- and let's say possibly incongruous situation that the U.S. could get itself in if for example, plants in the United States, if they were built GTL plants, would not be regulated for greenhouse gases or regulated to a lesser degree than plants overseas and the same thing goes for energy use. I think that the whole thrust of EPAct was looking at the effects within the United States which go to air quality reductions and focusing on that rather than on what the emissions are in another country, which are presumably the province of that particular country and those countries are more likely to have signed the Kyoto Treaty than we are.

And you will then get into a situation where you've created two different classes of plants, those in the United States and those overseas, and to avoid this incongruous situation, I would tend to agree with Syntroleum's comment that let EAP (phonetic) be the province of that particular country and let us look at the effects of air emission reductions in the United States.

MR. BROOKMAN: Additional comments on the second bullet? You can tell I'm moving rather rapidly, so I'll give you one more shot. Additional comments on the second bullet before I move to the third? That being N0x reductions in the range of approximately 6 percent substantial environmental benefits in light of reductions expected from EPA's post-2006 standards and possible greenhouse gas increases, the new standards that are going to take effect. Comments on that one?

MR. WOODWARD: Steve Woodward with Syntroleum. Do you wish us to comment if we've already submitted comments to the record?

MR. BROOKMAN: No.

MR. WOODWARD: Okay.

MR. BROOKMAN: That is, if you've covered it, you've covered it. We'll looking for -- this is an additional opportunity. Not everybody has commented on the record at this point. Bob, did you wish to comment?

MR. FREERKS: Well, I do want to say that we don't know all the technologies that will be used to reduce N0x emissions from vehicles, but a lot of the technologies are using a reductant whether it's urea or fuel. And either one of those reduction technologies consumes some energy. I've heard numbers in the four to eight percent for fuels and I don't know what the urea use will be but there's energy involved with producing urea and in consuming fuel as a reductant.

But anything that reduces engine-out emissions will reduce the amount of reductant needed in those selective catalytic reduction catalysts. So, yeah, anything that is reducing engine-out N0x is going to improve fuel economy even if it doesn't actually impact the engine or the catalyst out N0x emissions. You have to take that into full account. Do you understand what I'm saying?

MR. GOODMAN: Yes.

MR. WANG: I have a comment --

MR. BROOKMAN: Loudly, Michael.

MR. WANG: I'm from Chicago now.

(Laughter)

MR. WANG: Anyway, we did notice that from some preliminary test emissions controls of diesel engines there are some fuel economy apparently. So if there is a premium fuel will help emission control of diesel engines it should have some benefits of fuel -- you will reduce the fuel economy but I have not seen any benefit, we use Fischer-Tropsch diesel so much reduction, we will have our emission control effort as you would have with conventional diesel.

MR. BROOKMAN: Right. Okay. Do you want to follow that?

MR. FREERKS: It's, I think, way too early to tell. I think all these technologies are in their infant stage and the best I can go by is discussions with Cummins that they are excited a higher hydrogen content fuel being a much better reductant than say urea than conventional diesel fuel might be and they said, "Hey, you know, maybe FT diesel might be better as just a stand-alone reductant than as a fuel". So but to me it's way too early to tell. It's just the technology will move forward and we've got to at least think of what could be happening. This is one thing that could be --

MR. BROOKMAN: Other comments on this final bullet on this page?

Several of you have already addressed this in your comments that I read at least. Okay, I'm moving on. Process energy limits, some of you suggested that process energy limits should be in place. Others suggested that process energy should not be used, that -- that's the summary. I won't go any further. Does any -- any additional comments on this point?

MR. COLVILLE: Steve Colville from Sasol Chevron. I would suggest that this is an industry which is very much in its infancy and make a decision based for the future of the industry on how it sits with its technologies right at this moment would probably be inappropriate, that in a few year's time there could be large steps forward on some of them, removing perhaps the oxygen trains at the beginning of it or even through sequestration of CO2, et cetera. All of those were greatly impacted and I think we should not straggle the baby at birth by perhaps setting these.

And the suggestion from Syntroleum that it doesn't exist for other fuels, it's probably a good idea that we shouldn't try and apply a test here at this time in particularly.

MR. BROOKMAN: Okay, thank you. Additional comments on this point? Yes, Marc Goodman.

MR. GOODMAN: I just want to point out these other fuels that we're talking about, DOE has not made any determinations, you know, that those fuels specifically have substantial environmental benefits. In some cases, you know, natural gas vehicles, I think are pretty much accepted. This is the first fuel in the diesel engine category that DOE has had to basically make a determination on. We have to look at those things and some of these other things done have substantial -- I hope that people don't have the impression that when we talk about setting process energy limits, that necessarily means that the process energy limit is going to be so stringent that it's going to knock out their particular process.

You know, we might be talking about a process you know, somewhat farther out simply to prevent technology from going in the direction, you know, that exceeds some further limit.

MR. BROOKMAN: As a matter of both specification and also to kind of set a target up, performance target almost, right?

MR. GOODMAN: Yeah.

MR. BROOKMAN: Okay, comments on that?

MR. WOODWARD: Steve Woodward, Syntroleum. Setting performance targets on commercial endeavors, I don't believe is appropriate. And I'll just leave it at that.

MR. BROOKMAN: Thank you. Okay.

MR. McNUTT: At the risk of airing issues that we should have discussed in-house, and Barry McNutt, DOE Policy. The Department has been publicly and openly critical of EPA for over-regulating to achieve its goals and I have some fear that we're moving in that direction here. Markets work, energy is expensive, people increase efficiency in plants and it seems to me that we ought to keep focused narrowly and I could appreciate Marc Goodman's comments that we have to make a decision about what are significant environmental benefits, but this is an EPAct fuel determination, not some sort of determination God's going to make forever about, you know, what are good fuels and bad fuels.

And so I think from a policy perspective here, less is better in terms of setting limits that are going to create problems later that we have to revisit later or whatever the case is. And markets work. What's the natural tendency -- I mean, whether this fuel is durable or not -- I mean, ASTM, these fuels are going to have to pass commercial specifications. We've been dealing with a lot of issues and this is just one more issue where we seem to be ignoring the fact that commercial reality and economics is going to drive this fuel and we ought to take that as a given for the process. So less is better in terms of what we would regulate would be my argument.

MR. BROOKMAN: Thanks very much. Thank you. Other comments on this one? Okay, I'm moving onto the second -- the final bullet on this page, if so, at what levels should the limits be set in relation to energy use in production of conventional diesel? Maybe that's no longer -- should I move on? Are there comments on the final bullet on this page, noting what we've just heard? Some would say that's not a relevant question any more based on that.

MR. WOODWARD: Well, it's a different question.

MR. BROOKMAN: Yes, related, yeah. No. If so, what levels should be set in relation to energy use in production of conventional diesel?

MR. WOODWARD: Steve Woodward with Syntroleum. I think the question begs the issue of what is conventional diesel and how is it manufactured, what is the feedstock going to be? Is it going to be cycle oil, gas/oil, cracked products from the refinery, all of which will require more energy to process than straight run distillates. It was the issue that I raised earlier that in a comparison of greenhouse gases and/or a comparison of energy uses. You just can't say conventional diesel and I don't want to get into the whole issue of substitutional determination. I'm just saying a diesel fuel is a blend of components that come from a refinery. Some are easily obtained and are energy efficient. Some are grossly energy inefficient as to remove the sulfur compounds from them to meet parts per million that would be required for EPA.

MR. BROOKMAN: Okay.

MR. WANG: Let me add a different perspective to what Barry said. I agree with Barry that on the energy issue per se, market will be sought because everybody pays for energy itself. But I think we have to think when your options. What are your underlying issues which causes energy efficiency. I think the one issue I can come up is greenhouse gas emissions. Greenhouse gas emissions are not addressed in the marketplace, of course, it will depend whether greenhouse gas emissions issue is an issue in the United States and we know it may be a lesser issue in the United States as in other countries. So if we view greenhouse gas is an issue, some other countries maybe some time in the future, it's going be an issue in the United States, then we have to think about Fischer-Tropsch diesel, have we met it, so without any limit, without any safeguard or we need to think about that. We have some safeguard. If we say we can tolerate, say hypothetical, a slight increase and we say we tolerate 20 percent increase, or if the studies show you're within the uncertainty range, and still we need to have some safeguards. If Fischer-Tropsch diesel planned efficiency has not go as low as the regular power plant efficiency, then we should feel comfortable, we put some safeguard in place to make sure greenhouse gas emissions do not go above any of your perceived or predetermined upper limit. So I think that's the issue I could not favor.

MR. BROOKMAN: Yes, your name, please. Use the microphone, please. Yes.

MR. WORHACH: It's Paul Worhach from Nextant. This is a point that has come up at least several times, whether conventional diesel is the appropriate only baseline for this. I would not want to include gasoline, as an additional baseline to compare energies.

MR. BROOKMAN: Thank you. Thank you. Okay, so I'm going to move on.

MR. GOODMAN: Can I just make one point before you --

MR. BROOKMAN: It's Marc Goodman.

MR. GOODMAN: Yeah, I would just remind everybody as we said -- we noted in the White Paper, if you look at Titles III and V of EPAct everywhere where it mentions a specific environmental criteria, an environmental benefit or detriment, it's greenhouse gas. It never mentions criteria pollutants specifically. We believe logically, you know, it's reasonable to look at weighing criteria pollutants against greenhouse gases and saying that possibly they're more important, possibly they outweigh the greenhouse gas, you know, any greenhouse gas detriments. I don't think, you know, you can ignore greenhouse gases entirely and some of the comments have almost, you know, amounted to that.

Perhaps that wasn't --

MR. BROOKMAN: Okay, criteria pollutant benefits, setting fuel parameter limits -- is setting of fuel parameter limits the best way to assure reductions of criteria pollutant emissions? We've already had some discussion on that.

MR. WOODWARD: Steve Woodward from Syntroleum. Yes, fuel parameter limits should be set. A unified specification should be established for Fischer-Tropsch diesel and we have suggested certain limits as have other petitioners and other cementers today. We'd leave it up to the Department of Energy to assess that information and come up with what they think are appropriate specifications.

MR. BROOKMAN: Thanks for getting us started. Other comments on this subject, and you can see in the second bullet a couple of alternatives, a range, at least on the parameters themselves. Steve, since you started before, do you want to state what you all suggested was the appropriate --

MR. WOODWARD: Yes, I would be happy to. Parts per million on the sulfur would be one part per million max. Minimum cetane number of 70. A maximum of aromatics including PAHs of 500 parts per million by mass. And oxygen content of 100 parts per million by mass.

MR. BROOKMAN: one hundred parts?

MR. WOODWARD: Yes. And oxygenates, 1,000 parts per million by mass. Other ASTM specifications to apply with the anticipation that lubricity will be answered soon by an ASTM committee and this should apply to neat Fischer-Tropsch fuels with no additives specified.

MR. BROOKMAN: Is neat, n-e-a-t?

MR. WOODWARD: N-e-a-t, yes.

MR. BROOKMAN: Thought so.

MR. WOODWARD: And that the addition of additives to take care of lubricity and/or seal swell and/or any other thing that seems to be of concern between the buyer and seller be addressed on a commercial basis.

MR. BROOKMAN: Okay, okay. Other viewpoints, yes. Cyril.

MR. KNOTTENBELT: I think differing from where you're coming from I'd just like to caution with that one PPM sulfur, once you take your plant up to a full scale production, you might find yourself painted into a corner with one PPM sulfur depending on some processes that you've got around and what your selection of gettlers (phonetic) may be so I'd like to perhaps push for a higher sulfur content of being 10 PPMs mass max at in ASTM 4345.

Then just moving on in terms of cetane number, we're still proposing a cetane number of 50 minimum and I think looking at the emission results of similar fuels you can see the reductions in N0x, you can see the reductions in particulate matter as well as CO and CO2 emissions. So I think the results speak for themselves and then aromatics as tested by RP 391, limit that to 10 percent volume max and PAHs to be less than .1, the same volume maximum.

MR. BROOKMAN: Okay.

MR. KNOTTENBELT: Thank you.

MR. BROOKMAN: Thank you. I missed these. Did you address these? Did I just miss those? Oh, you've got it, okay. And Stuart?

MR. BRADFORD: Yeah, I just had a quick comment and certain specifications that would in fact be difficult to measure a way, you'd be vulnerable to contamination at very low levels. One PPM sulfur, you would be vulnerable to contamination as you ship the stuff around and you measure it. I'm not the scientist, can you accurately measure that low? We should just be careful about that.

MR. BROOKMAN: Okay, thank you. Marc, do you want to --

MR. GOODMAN: Yeah, on that point, in the EPA independent review panel, we had a number of presentations on that issue of monitoring sulfur at various points in the pipeline and my understanding is that the test that are most excepted today the tolerance is about three PPM, so in order to -- to assure one PPM would be a negative two.

(Laughter)

MR. BROOKMAN: The next slide, we've addressed some of these.

MR. WOODWARD: Just a second. We can't let that comment -- there are appropriate test methods that can measure sulfur concentrations down to those levels. If the DOE is going to be monitoring and policing energy output from a plant and greenhouse gases from a plant, then they can certainly measure the sulfur content that comes from the plant and the specification would be valid.

MR. BROOKMAN: Okay, thank you.

MR. WANG: I have a minor clarification for our industry representative.

MR. BROOKMAN: Louder.

MR. WANG: When you talk about a limit, do you mean a refinery gate or in bulk terminal or stations?

MR. WOODWARD: I am specifically referring to refinery gate.

MR. BROOKMAN: That was Michael Wang, followed by Steve Woodward in that last exchange. Your name, please, for the record.

MR. McNUTT: Barry McNutt, DOE. Two comments, one on the sulfur. I think the relevant issue here is what sulfur gets in motor vehicles. It is how EPA has specified the sulfur level and I can't fathom the reason why we picked a different level for the purposes of defining the sulfur level in this fuel.

Other parameters, because we're claiming incremental emission benefits may be different but -- and the second comment is, why not emission performance, why recipe specifications. Once again, EPA has been criticized roundly by everybody in the fuels industry and including the Department of Energy over setting specifications and not performance requirements, which goes back to the whole question of defining this fuel's environmental quality in terms of its performance rather than in terms of its parameters.

MR. BROOKMAN: Thank you. Additional, yes, please.

MR. WILSON: Steve Wilson. I'm a little unclear as to why we believe an oxygenate spec is necessary. In some publications we say oxygenates is beneficial for emission purposes. I think some people have published values (inaudible). And so some would argue you need a minimum rather than a maximum.

MR. BROOKMAN: And that's the reason we're having a workshop like this to discuss issues precisely that way. Bob.

MR. McCORMICK: This is Bob McCormick. The reason -- I think what DOE has suggested is a limitation on oxygenates that have not undergone the EPA registration process and that is to avoid certain specific oxygenates that might have nasty toxic problems. They might be get in but on their own they might be

(inaudible)

MR. BROOKMAN: You've got to speak into the mike.

MR. McCORMICK: -- have a toxic problem.

MR. WILSON: Maybe we should specify them rather than oxygenates in general.

MR. GOODMAN: We did. This was just a shorthand for those others, yeah. Anything that has undergone the Tier 1 and Tier 2 testing, for example, bio-diesel, you could blend in this without any problem. What we're really talking about is unknown oxygenates because a number of people suggested that we have an oxygen standard of one percent oxygen or 1.19 percent oxygen and nobody's told us what the oxygenates are. You know, even without the EPA Tier 1 and 2 testing if we had an idea what they are, you know, we might come to a different conclusion, but in terms of any oxygenates that might come along, you know, we think there might be a need to set standard specifications.

MR. BROOKMAN: Yes.

MR. COLVILLE: Steve Colville from Sasol Chevron. I would think I would support Barry McNutt's point of view here, where we have to think about carefully what is it about this regulation we're thinking about here and one thought of regulation is often it's for the obedience of fools and the guidance of wise men and in this industry that's going to be formed, I hope we're going to be wise men. The deft light touch of regulation seems to make a lot more sense. I'm a bit concerned when we start talking about the cetane levels, for example. There's a big difference, almost a fundamental difference in process and outcome of products between high temperature and low temperature Fischer-Tropsch.

And clearly from Petro S.A.'s position, fundamentally their in a position potentially being shut out on something as fundamental as the cetane. The question we then begin to hear is does it have a huge impact and is that really one of the benchmark tests that we ought to have and as we start applying that, we hear that for sulfur. I think there has to be a fundamental policy decision taken as to whether it's going to be a light deft touch regulation that has clear purposes and posted benefits, rather than ask -- because a lot of these have been asking us questions on specific all these measures, rather than saying, are all these measures necessary? Can we try and have as few as possible and if we were, which ones would we put in a hierarchy of choice to actually guide us?

MS. BLUESTEIN: Linda Bluestein, DOE. That is precisely what we're after, the type of comment that you just gave, so thank you.

MR. BROOKMAN: And I'm sure the Department will welcome additional comments just that same way in writing. Bob.

MR. FREERKS: I'm not going to comment whether or not we should set a tight or loose sulfur spec but there is an awful lot of pressure from the engine manufacturers to reduce sulfur down to the lowest level possible for durability of nitrogen oxide traps which are poisoned by sulfur and I think their input should be considered when considering the sulfur specs and since they are going to be the main beneficiary or burden bearer for the sulfur in terms of emissions, their view probably is the most important.

MR. BROOKMAN: And have we received comments from them?

MR. GOODMAN: No, they've been invited and we haven't.

MR. BROOKMAN: Marc Goodman, the answer is no, so I wonder if there's some way to get the engine trap manufacturers, is it?

MR. FREERKS: The engine manufacturers and the trap manufacturers all are going to be integral in the emissions-out regulations and the durability of what 140,000 miles for heavy duty trucks?

MR. BROOKMAN: Well, if any of you have access to them, perhaps you could encourage them, as I know the Department will be following up with them as well to send their comments to the Department of Energy. Other comments? Do you have some additional criteria including benefits? We've described some and we've certain described sulfur. Density, we referenced earlier in the day. We've -- Steve, I think was talking about -- or Bob was saying it's going to meet ASTM. Steve also said that.

Other -- as you look at this list, other comments that we have not covered already? No additional comments on what's there? Have we adequately addressed the issue of paraffins, the different kinds of paraffins? You've arrayed them for us, in terms of, you know, the EPA fundamentals on their toxicity?

MR. STORK: Yeah. Kevin Stork here. I want to step back a minute. I was thinking about the sulfur issue again, and I think it's worth pointing out that whatever sulfur spec is chosen in this process, be it one PPM, 10 PPM or whatever, we are still only talking about EPAct designation fuels which is maybe one-tenth of one percent of fuels. So in response, in a sense, to Bob there's really nothing that would prevent the use of Syntroleum product as a diesel fuel in the broad market, wherein you know, 15 PPM, however you get there including by blending, is a desirable property and I fear sometimes in this process, we may be really missing the forest for some of not just trees but some of the smallest saplings imaginable.

MR. BROOKMAN: Additional comments? Nothing additional on this slide, I'm going to move on if not. We're getting towards -- we're making good headway with this. We've got about one, two, three, five sets of issues left for those of you that are wondering how we're doing. Linda Bluestein.

MS. BLUESTEIN: Linda Bluestein. I thought that the stakeholders here did a pretty good job of addressing that first bullet earlier in the day, so I'm not -- I think we can -- unless somebody wants to make another comment, we could probably skip over it.

MR. BROOKMAN: Additional comments? Okay, we're moving on. I see heads nodding. On to would low density Fischer-Tropsch diesel fuels cause power loss at fleets that would compensate for timing changes at the expense of emissions, we've heard -- someone mentioned that earlier today.

MR. GOODMAN: They mentioned that some research was being done and the results will be available sometime a year, year and a half from now.

MR. BROOKMAN: Okay, okay. Additional comments on that issue specifically? Any other thoughts on whether that's going to happen or not?

MR. SOWARDS: Yeah, we solicited some comment from Detroit Diesel, who has publicly stated that with some of their current as well as advanced engine designs, that they can take advantage of the emission timings and not have any negative effect as far as fuel economy as well as any additional negative effect or with regards to emissions.

MR. BROOKMAN: That was David Sowards. Thank you, David. Additional comments on that one? Marc Goodman?

MR. GOODMAN: You said that's with their current and future generation diesels, is that what you're saying?

MR. SOWARDS: Yes.

MR. BROOKMAN: Some engine manufacturers or one. Did you say it was Cummins? Thank you, Detroit.

MR. SOWARDS: These are public comments by Detroit Diesel.

MR. BROOKMAN: And change, timing, no impact. That's kind of like that. Okay, I'm going to move on.

MR. GOODMAN: I think we've covered all that.

MR. BROOKMAN: Additional comments on this slide? Greenhouse gas emissions options, which control option should DOE adopt if it makes an FTD designation? You see them there, a range. No control, designate only FTD from class meeting process energy limits, designate only FTD from plants exporting steam, electricity or from flared gas. We've heard already several advocates for no control, right? Other comments? No additional comments on this?

MR. STORK: I have a comment, Kevin Stork, DOE. This isn't actually directly about this and I realize I missed the slide in which process energy limits were discussed but I was curious to know whether there's been any type of consensus about exactly where to draw the boundaries in defining energy process limits and to that end, I would put my vote in with the middle option of correlating it with process energy. I guess I'd go a little further and suggest that you know, unless it's -- I think you may be sort of entering a morass by considering process energy limits unless there is some sort of definition that I don't know of.

MR. WANG: Yeah, that's why --

MR. BROOKMAN: Michael Wang.

MR. WANG: Michael Wang from Argonne. That was the comment I had with Barry's comment on energy efficiency basis.

MR. BROOKMAN: Okay, we heard from other commentors, other persons during the day that they were worried about -- they didn't say entering a morass but they said it would be very difficult. Right? Other comments on this -- on this slide?

Oxygenate issues. We've already spent quite a bit of time on this as well. Additional comments on this? Do you want to get up and stretch for a second? We're almost there. Okay. Additive issues, any special additive requirements? We've acknowledged that ASTM is going to be coming up with their specification and that addresses the bulk of the additive issues, would it not?

MR. WOODWARD: Steve Woodward with Syntroleum. I think additive issues have a special focus as to lubricity because it is an area that has been identified to be one that needs to be addressed, but I think the broader issue is, is that additives are added to all diesel fuels in one form or another and that we shouldn't break that mold, that the fuel should be designated and whatever specifications, performance criteria we decide on the additives should be a commercial issue.

MR. BROOKMAN: Okay, a commercially designated issue. Other comments on the additive issue? Gregg?

MR. SKLEDAR: Gregg Skledar with Sasol Chevron, I think the other thing to note the lubricity is specifically a sulfur issue and that the entire industry is moving to a low sulfur fuel and so that's going to be addressed for the whole industry and like I said, it's a commercial issue that is already well understood and there's additives out there to deal with it.

MR. BROOKMAN: Okay, that is the end of the specific questions that we had listed here. I refer to my agenda and I don't think -- we wanted to provide an opportunity to -- for other people to make final comments, raise additional issues, bring thoughts to the table that haven't been stated already. We've had a good conversation today. We've covered a tremendous amount of ground. My thanks at the outset right now to the presenters for their additional comments. Yes, please.

MR. COLVILLE: One comment I was going to make, I think it was when Linda was making her presentation this morning, was I right in thinking the one slide you were going to return to was the next steps timing?

MR. BROOKMAN: Yes, which we will do.

MR. COLVILLE: Sorry.

MR. BROOKMAN: We'll return to those. Thank you, though, for quing us in that direction. Additional comments, thoughts, ideas, specifics that we haven't covered during the span of the day today?

MS. BLUESTEIN: Linda Bluestein from DOE. I think this has been really useful for us. You know we had a lot of issues that we were looking at and that we looked at and looked at and maybe overlooked as some of them, and I think you know, somewhere between over-regulating and under-regulating there's a middle ground, and you know, I hope that we can do the right thing and work with the folks in this room to achieve something that is desirable from the public viewpoints as well as help foster industry along.

And I guess maybe I can just get back to that last slide about what our next steps are and before I do that, I do want to thank everybody for your thoughtful comments and information, particularly the petitioners that have kind of been submitting data to us, some for the last two or three years. We really appreciate your fortitude in sticking it out.

At any rate, under our next steps, what we have to do is go back and review these workshop proceedings and comments that you'll be submitting through November 15th of 2002 and then, you know, we're going to try to make a decision on whether to go forward with the designation. Of course, that will -- if we decide to go forth positively, that will involve figuring out, you know, what we want our rule to look like and as you can see, we have a lot of different issues to sift through. So that will take some time.

If it's positive, I really hope that we can have a NOPR draft written by the spring of `03 and then it will be subject to a lateral review within DOE but also I believe that I've heard that there's also a three-month OMB review period that the rulemaking has to undergo, so and that already there is about six months between comments on the NOPR and the OMB review. And then if we're really lucky and all of that goes smoothly, you know, maybe we're looking at winter `03 or early `04 some time for our final rulemaking.

MR. BROOKMAN: I can't hear you.

PARTICIPANT: It says winter `04. She just said winter `03.

MR. BLUESTEIN: Right, winter `03 or winter `04, I guess, is winter. Early `04.

MR. GOGUEN: Steve Goguen here, DOE. Way back in the beginning of this I gave a little presentation and to put it in the context, we have two program elements in our fuels group and the first being technology development and the second being our regulatory process. And it kind of creates an interesting situation in our office where sometimes Linda and I have to think of firewalls between us because I can't -- you know, being that we do technology and development, and also on the regulatory side, it's hard for us to talk to people if we're in the middle of our regulatory process with them and so forth and so on. But

I think we do a good job at it.

But I would like to just add here that as Kevin had pointed out, we are outside of the regulatory side of things, on the R and D side of things, we have an extreme interest in your product as a potential, as a blending agent in diesel fuel. So, you know, there's two sides to the house and we're not opposed to each other at all. It's just that there's certain rules and regs and there's certain benefits to being an EPAct designated fuel and I wish you all the luck in the world to everybody here and I know the process will be done fairly and you know, what you get from that will be of benefit to you, I hope. And I hope that also on the flip side, on the R and D side you realize that we have a strong interest in your fuel as a potential blending agent in diesel fuel.

MS. BLUESTEIN: I think we're going to let everybody go now. So I do really appreciate all of your -- the information you submitted, for showing up and sticking it out with us all day. I think we had really good attendance at the meeting, great feedback from the stakeholders and we will take all your information and we will also hold you to getting us this data if you're on the hook for it and we might bother you if you don't get it to us in a timely way. But at any rate, we have all your phone numbers and e-mail addresses so we may be following up with you and I hope you also feel free to keep the communication open both ways.

Call us if you need to have your questions answered and we will do our best to work with you.

MR. BROOKMAN: I see one additional question.

MR. WOODWARD: Yes, Linda, I have one question. The official docket, how would one avail themselves of the information that has been placed in that docket?

MR. BLUESTEIN: The official docket is on our website which is in the -- I mean, you have availability to everything we have in our docket on the website.

MR. WOODWARD: What about all the comments which may have been received by parties that aren't represented here today?

MS. BLUESTEIN: We will put all of those on the website, every single one.

MR. WOODWARD: Okay.

MR. BROOKMAN: Let's list the website.

MS. BLUESTEIN: Okay, it's out -- I'm sorry, the website is ott.doe.gov/epact/fuel_pet.shtml and actually that's sort of the website for the whole fuel petitions program. You can go on there and click. There's a little box on there to get right into the electronic docket.

MR. BROOKMAN: Thanks to all of you, travel safely.

(Whereupon, at 4:11 p.m. the above entitled matter concluded.)