Int1: Let's get started, and if other people join, then they join. It's so fantastic to see so many people here and from such a diverse background as well. That is just wonderful; it's exactly what we need for a project like this. I think I have met most people here. I can see a few names that I know but I haven't spoken to everybody. So what we're doing today is a bit of an introduction to the ME-NET project. I'm going to go through a bit of a welcome and a bit of an introduction on the project. I know that everybody knows a little bit about the project, but just to bring everybody up to speed. Really the main purpose of today is just about showing everybody some of the content that we've started to develop for this educational application that we are working on, that is about health protection, and the role that methane and ozone play in impacting people’s health. So we're working with this fantastic team called Common Knowledge who are UK based design and development team, and they are supporting us with the components of this research which involves developing an application for people’s health protection, meaning an application for mobile phones and also for websites. We’ve started working with them and developing some of the content. We are so pleased to see everybody here. This team is our expert group, lived experience experts, everybody here has expert experience related to this project. So we will be showing you some ideas that we've had so far about the project. And then we will be asking for your feedback as well. That's what we're doing today, and we will discuss future meetings as the project goes on as well.

<shows ethics and consent slide> <discusses pre-survey about ethics and consent.>

Int1: This is basically ethics consent for the project but also an opportunity for me to find out who everybody would like me to coordinate with. So there are some survey items in here that ask - Who would you like to collaborate with in the future? I know there seems to be a lot of interest from our meteorological societies to have a bit more to do with each other our two regions: the UK and Ghana, which is fantastic. I will say we’ve seen so far lots of interest from NHS organisations to work across the Ghana Health Service as well. So just an opportunity for you to express an interest. So we'll start with introductions. I'm just going to go through a list that I've got on my screen. We are going to introduce ourselves. Some people in this group know each other, but a lot of people don't. So we'll just go around briefly and say names, the institute that you come from. But also, I would invite you to think about your lived experience. So what group of people do you work with who might be interested in an application about health protection related to the environment. So this is about air pollution and the impact that it has on people's respiratory but also their mental health. So what is your expert background? And also, this is a bit silly, I would like to know what everybody thinks of, what comes to mind when you think of methane? Because part of the project that we're working on is about learning more about the impact that methane has. I will start, for those of you who don't know me, my name is HM, I work within the Lincoln Institute for Coastal and Rural Health. In fact, this is my first day in that new role and I'm very excited. I used to be in geography. And now I am a geospatial, health expert working in this new institute that we have. When I think of my lived experience, I think of myself as the lived experience in a few ways both in my own understanding of mental health and the people around me. When I think about methane, I think about the colour orange. Before I started this project, I had no idea about anything to do with methane. I will call out your names as I see on the list, if you are able to, please turn the camera on, if not then turn the microphone on and that's absolutely fine. If you are having trouble responding via microphone, you can always type something into the chat and we can all read it. I will start with A?

Res1: My name is AH. I am a senior lecturer in the department of physics at the University of Ghana. I work in the area of air quality since 2006. I have an air quality lab and we do all kinds of stuff here. We look at validation of satellite data with ground based monitors. We also have a centre at the department of which I am the head called AFRISET, which is the air sensor evaluation and training facility where we sensors from across the world and evaluate them in Sub-Saharan Africa. This is the first centre. So we do evaluation and we do training. Yes, I'm interested in this work because I think methane is one of those greenhouse gases that contributes a lot to what we call climate change. And that's how centre, we do more particle matter, but I have worked with other colleagues where we had to use the LEAP IBC to kind of do some emission inventory for a particular part of Ghana. We're also looking at the impact of meeting on the locality.

Int1: Fantastic. Thank you so much. Dr S?

Res2: Good afternoon everyone. My name is S. I am based at the University of Ghana. I'm happy to be part of this. My research interest is mostly on mental health, but for the past few years, I have been trying to extend the discussion to climate change and how it impacts mental health as well as physical health in general. And in the area of methane, I haven't worked in that area specifically, but I have explored climate change relation to health outcomes to both maternal and child mental health.

Int1: We will move on to E, from the University of Ghana.

Res3: Hello everyone. My name is EA. I am a senior lecture here at the University of Ghana in the department of geography and resource development. I would say that I am a local collaborator with H. I do a lot of that coordination and ground work. In terms of my research area, I am an urban geographer and over the years I've done work on climate change and health and also on education. When I think of methane, it's new to me. As a geographic, we worked on waste management, but we have not really looked closely at issues of methane. I look forward to working with this diverse team because I believe it's one of the pollutants causes a lot of respiratory risk and other related health issues. It is good to see you all and hopefully we will have a fruitful, not just session, but project together.

Int1: Thank you. I should say that E have been fantastic supporting from Ghana. E from GMAT?

Res4: My name is E, I'm from the Ghana Meteorological Agency, I'm with the Research and Applied Meteorology department. My research focuses on keeping my interest in atmospheric chemistry and aerosols and climate change science and impacts. I would like to pursue a career that combines my research. I aspire to be a world class environmental scientist and researcher in various fields connected to chemistry.

Int1: It's great to have you here, thank you for joining us. Next on my list is JC?

Res5: Hi, good afternoon everyone. My name is JCK. I work in the Weather Position Office and we intend to run a webcam which would include doing the simulation for your methane. I don't know much about anything, so I think this workshop will be a nice opportunity for me to get more information on it.

Int1: That's interesting to hear that you're working on simulation, that's great to have you here. Next on my list is J?

Int3: Good afternoon everyone. I am JA, I'm actually in the School of Engineering and Physical Sciences. I am a senior lecturer at the University of Lincoln. I am the core investigator on this ME-NET project together with H. I have little knowledge when it comes to methane. My background is mainly in computer science. My research interest is around computer vision, machine learning and deep learning.

Int1: Thank you. For everyone in the project, I have mentioned J to everyone, he is a computer scientist who is working with our environmental and meteorological data. I can imagine there are some other conversations to be had about what we're doing with methane data, that we might be using to simulate or to forecast methane for Ghana as well. E?

Res6: I work in the Ghana meteorological society. Specifically within the climate unit. We research air quality, we're at the moment we're trying to look into low cost, efficiency in monitoring air pollution also taking of the geological data. As well, we're running a project with some senior high schools where we've stored about 10 low cost sensors. The main name was to educate students in the awareness of the issue air quality and climate change, and also for live data which could inform policy making.

Int1: Super interesting to hear that you're doing work with high school and sensors. We are doing something similar at Lincolnshire actually with a group called Clarity. I wonder if it's the same group because I know that doing some work in Ghana. We will now go to JA?

Int2: My name is S, I am originally from Ghana I was at the University of Ghana for both degrees, 1st and 2nd degree. I did a Masters at the school of biology in Legon, and then nursing and psychology in the school of nursing, also a Legon. I ended up in the UK here and I work at the University of Lincoln with H and J on this project. I didn't know much about methane, but thanks to H and J pushing me, so now I think about evolution when I hear about methane. I think about climate change. I think about how we think and react with other gases to form ozone. It's nice to meet brothers and sisters from Ghana, and I hope we will meet later again after this meeting.

Int1: You will because Jo and J, and I are in the team that are coming to Ghana next year. It would be fantastic to see everybody in person as well. Can we now hear from our second J?

Res7: I am JSY. I am with the institute for oil and gas studies at the Investor Cape Coast, and really my key areas are the climate and energy system modelling and others interestingly, until 2020, I was with the Energy Commission of Ghana, in charge of the policy and planning. I was handling energy statistics, and then projections and planning for the country. And then nationally too, I'm part of the national team for the Ghana climate change negotiations. And then also, Ghana’s utility on the global retain initiative, in the area of energy. Well, we have the greenhouse gas inventory, and then we are key in me thing because methane is the key active or we say most combustible or highly inflammable gas in natural gas. So very key. I emphasise that, it really has the highest contributing factor to greenhouse gas emissions compared to CO2. Even though the percentage is very small, by real intensive potential is far higher than CO2. So it is key. So the global methane initiative, or DMI, are interested to see the leakages in the oil fields and also the gas fields and also the processing because if you are able to measure all these leakages then you can see the potential impact on the climate. But currently, besides that, in terms of clean energy aspect, the last two years I was for the UN elected mobility project in the country. That's where my interest has been with methane in the past. Later in terms of air pollution. But really, I see air pollution is very important when it comes to the developing world. I keep saying when you talk about the advanced world, when I work there, I don't see much of air pollution, and then land and water bodies. But when they come to developing countries like Ghana there was a big challenge. So at times I say that the issue of intensive environments is not only climate, climate is just one aspect of the environment. But also the geosphere, issues with land pollution and then the air pollution in general, the atmosphere pollution, not only climate, application we also talking about. And then also the hydrosphere, that is the pollution of a sea body.

Int1: Thank you so much, you have so much experience. I'm sure there are other conversations we can have about satellite data. J and I are starting to look at satellite data, we know there's some new satellite data coming online too. There's so much we can talk about with methane with you, your experience is invaluable so thank you Very much for attending.

Res7: You are most welcome.

Int1: Next on my list is M? Would you like to introduce yourself or should we come back to you? We'll move on to M for now and come back to M.

Res8: Hello everyone, I’m M from the Ghana Meteorological Agency. I am the principal meteorologist and external relation officer. I'm happy to take part and also I would like to say on behalf of our Director General that he would also love to be here, but he has to engage in another activity. So for achievement, we are responsible for weather in climate information in terms of saving lives and properties, which is also including air quality. Currently, we just provide information on how much the hazy conditions that we experience are within the country. In terms of going into details, the compositions of aerosols, we are not in that space yet, and it's something very great for us that we're looking forward to exploring. And also, being able to provide air quality forecasts with this vector all different types of atmospheric aerosols. So we are happy to be here in the meeting. Methane is one of the greenhouse gases leading to global warming. In terms of the health impact, I think that is not been well explored in Ghana. So looking for web of this project be an initiative, and looking forward into the future, helping us to understand what the other components are of the greenhouse gases and how they affect is in various ways.

Int1: Thank you, it's great to have you here, and for passing on E’s apologies. I'm sure he is a very busy man. We will move on to S, and then go back to M?

Res9: Hi everyone. My name is S, I am a paediatric pulmonologist at Koleno Teaching Hospital. I have been a paediatrician for so many years, and then I went to do pulmonology, and then I came back this year and I have set up a unit, the first units of paediatric pulmonologist at Koleno teaching hospital and I'm very much interested in lung function testing. I've managed to put long testing in the paediatric pulmonologist clinic, which we didn't have before, we didn't even have a clinic before. So in my clinic, I see a lot of children who will even tell you when the weather changes. They will say - Because the weather has changed, I'm coughing a bit more because the weather has changed, I'm a bit more breathless. We have children with chronic respiratory illnesses, asthma, bronchitis, colitis, all kinds of diagnosis and allergies that have sort of an association with the weather. In addition to being the first paediatric pulmonologist in Koleno, at an organisation called baby child, and we are into advocacy. We have been in existence in 2017, and since I have become a paediatric pulmonologist, one of the things that we do is advocacy in the lung health space. So in May for instance, we held the first ever asthma summit in Accra but we had a patients education summit. Where invited people who have asthma, and if they had children, then with their parents and family. We had a lot of demonstrations about how to care for themselves with respect to their asthma diagnosis. This September, we won a grant from Healthy Lungs for Life, which is an organisation of the European lung foundation till host world long day for the first time in Accra. We're doing lots of things including public biometric testing and expiratory testing. That will happen around the 25th of September. In the clinic, I'm a lot into advocacy as well. For methane, he is I have been trying to make my own compost for my organic farm. So that's how I got to know about this meeting, apart from learning about the effects on respiratory health and having three papers on it so I can pass my exam. But practically, I haven't done any research with methane and all that, but I'm happy to be here because I feel like it's a shared interest. I'm at the clinic, and you are in the field, and then yes, we work together.

Int1: Thanks so much for that introduction. It's so interesting to hear everybody's backgrounds, particularly that you work with an advocacy group. That is a really unique lived experience. I know your insight will be really valuable in this project so thank you very much for attending. M, shall we have another go with you?

Res10: I'm good. My name is M-YN. I work at the Princess Marie Louis Children's Hospital, and I am a general paediatrician. So I see children with all sorts of things, and if I'm really stuck, I ship some off to S! In the hospital that I work in, we are sort of in an urban slum area, and pollution is really, really high in my environment and from car pollution do people burning all sorts of things. So we see a lot of children with respiratory problems, and sometimes we really don't know what is going on. We realise there is not always an infectious agent, so it would be interesting to see how the pollution affects the respiratory health of our children. I don't know much about methane; I just know that it's dangerous to our health. I don't know any details, so it will be exciting to learn more about it in this project. Thank you very much.

Int1: Thank you M. That's fantastic. Of course you work with S, so that's wonderful to have a diverse range of experience. So hopefully everybody knows a bit more about each other now. It's great to have a range of representation: healthcare, meteorology, researchers. It really is the perfect group of people to have together for this project. So I will move on to talk a little bit about our project, the ME-NET. Please ask questions as I am presenting.

<Begins presentation and covers the following topics>

- Welcome Trust funded project.

- Brief Develop a dashboard to understand the impact that methane has on health.

- Prototype project for running 12 months (July 1st, 2024 – June 30th, 2025).

- Multi sector collaboration.

- A first step towards understanding the role that methane plays in health. Also improving access to health outcomes, improving access to health services for adaption, and providing opportunities to support research ecosystems in data scarce regions.

- Aims: the pilot an integrated data platform (ME-NET) for regions with varying environmental and health data availability and quality, and with varying sources of methane emitters and super emitters for a) developing data synthesis approaches that are globally applicable, and b) training methane ‘early warning’ models that are robust to regional contexts.

- Outputs: 1. Machine learning algorithms showing the links between methane, ozone and health outcomes. 2. Phone/web app for Health Protection, tracking the impact of zone on mental health and respiratory symptoms, and education in the UK and Ghana, and (including coastal sites).

- Research Questions - To what extent can deep learning be used to develop an ozone early warning system that incorporates health data into regions of the world with a) higher and, b) lower/middle income, reflecting wider global variation in data availability and quality? - What are the most relevant health measures for exploring physical and mental health emergencies associated with methane and ozone concentrations in the two regions, and is it viable to use DL to predict great server emergencies associated with air quality? - What user functions would improve the visibility of climate change impacts, and how deliverables are these, given data availability and quality in regions?

<Displays ME-NET for smart phone and web application slide> please keep in mind as we go through that there are some opportunities for feedback on this content. What are the unintended negative consequences that could emerge out of a project like this? I will go through some of the main functions, and then there is an opportunity for feedback. It's not just the images, but also the visual kind of component of this, the flyers that I've been presenting from here on in have been co designed with the wonderful group that we're working with - Common Knowledge. So this is partly helping them prototype and trial what some of the content might actually physically look like in the application. Their process is around design justice, which is about iterative design, so day presenters with some images and we take them to our stakeholder group who can then tell us how appropriate you will think that is, if it is understandable.

- Four Main functions 1. Alert Me, 2. Explore and Learn, 3. Our Data, 4. My Profile.

<Displays Explore and Learn function slide and describes function>

<Displays mobilising citizen science for global social and ecological justice slide>

< Displays My profile and Alert Me slide and describes function>

< Displays methane early warning network slide and describes function>

Int1: I would like you to think about the content presented so far. Is there anything that's unclear, please feel free to raise your hand. Consider the people in your life, including your personal life as well as your professional life, and who might use an application like this. Are there any red flags? Let's take 3 or 4 minutes now come out if you're using a smartphone, you can use this QR code, if not you can put a link in the chat. When I say red flag, what I mean is, what could go wrong? Is there anything bad that can happen from any of the functions that I've talked about so far. What I'm going to do is just give you 4 minutes just to respond. We have a couple of survey questions about unintended consequences. I will just mention some of the comments as I'm reading these, and then open it up for discussion for what we think we could do about some of these challenges. So some of the issues that are being raised here are about data breaches, gender that we need to enable people to respond not just binary gender, that's a really good point that we can absolutely do. We also have some issues raised around the challenges of Internet access, web materials, limited access to the Internet, limited access to local information in local languages. The fact that people might narrow their focus on climate change to methane. Difficult to analyse data, data grabs. So there is some concern here for data security. I can certainly say now that we're looking at two-way anonymity in the application, and a high level of data security around this, and anonymity. We can provide some more information on how we're looking to do that. Some are coming through now - How can we make this disability friendly? - Not clear what the target groups are? That's an excellent point, we are very open to - How do you do that? Whatever it turns a few of the common themes that have come up from those responses. The first one is around how do you make a phone application like this disability friendly? I would like to open it up to anyone who has any ideas about this? J?

Int3: I'm not going to answer it because there's no particular answer to this, it will cut across a wide range of things, because when you talk about disability, there are quite a lot of things, probably it should cover colour blindness etc. It would be very challenging to have one answer to this, disability will cover quite a lot of things. For something like colour blindness, it would be important for us to know how to select the type of colours to use the application, and the type of colour scheme that's going to be used for the application. There are a lot of technical tools on the Internet that know about this already. There is probably a tool that can take care of this. But of course, there are other disability issues, but I can't provide the answer now, we can acknowledge it and share it shortly, but I've set the ball rolling, let's see what we get.

Int1: S, Let's just type into the chat that we probably need to invite somebody that works with disabilities. I think that's a fantastic idea, after this session, I will send around a little link with a post meeting survey, one of the questions on that survey is - If you think there are people that should be in this meeting, who are they? So maybe something else we could think about, and throughout this session, is who else needs to be here to answer these questions? What we really want to know is who needs to be represented in this decision making. So absolutely somebody that works with disabilities would be fantastic. I'm going to pose the next question. The second thing that seems to have come out quite a bit in those responses is around data security and data grabs. So there's lots of technological solutions that can help with that to enable anonymity. We can also heavily restrict who has access to the data that comes in. But I would like everybody to talk a bit more ground their concerns data. Is there anyone that would like to say a bit more about their concerns about that security, please do not speak? A?

Res1: In relation to Ghana, there is a Data Protection Act. And I think there has been a body that has also been set up where you register the type of data that you are collecting, how you collect it and store it. I think going forward, that is a now a law in the country. And so we're going to collect personal data, there would be a need to see what the access is about, this type of app that we're going to use.

Int1: I might actually follow that up with you specifically after this if that's OK. That's really interesting for us to know and we need to be 100% compliant. Thank you for raising that issue. There is another one that's come up that I would like to open to the group, you would be interested to know that this is a concern that came up with UK stakeholders as well. So the first part of concern is about anxiety: people's anxiety in response to this information, and misinformation as well, and also blaming local industries. So what we're interested in doing is educating people about atmospheric conditions and health. But there is a concern that is felt not just by this group, but also other groups that I've spoken to that this could end up blaming local industries. I would like to open it to the group, what do you think we can do to this application to address that concern? What can we do to address this issue that people might blame local industries?

Res9: I think it is a very valid concern. A lot of people who are prone to reacting to these environmental changes, people with like chronic illnesses, and they're already overburdened. So I can really understand this adding to their anxiety. What we can do is to put in phone numbers of people that they can discuss their anxieties with. - If you're feeling unnecessarily anxious about the levels of methane that you are seeing today or recently, please call this number and discuss. We also need to get them a lot of information embedded into the app that lets them know that these things are multifactorial, and it's one thing reacting with another thing cascading and so on, so they're not quick just sort of want to blame somebody. People may also want to know - What how are you doing with this information? Yes, you are empowering me to take care of my health, so to speak, but if you get to know that there's lots of methane being released into my atmosphere, into my community and so on, what are you doing with this information? So I think we also need to embed into it the overtime, information will be collected about the levels and analysed and people will be engaged, so that they see that something is being done about it. But I really can see the anxiety issue. It will happen.

Int1: Thank you, that is really useful. I love the idea up embedding connection to local support networks. That could be official health services, or it could be community services. I mentioned that survey that I will send around afterwards. Another one of the questions that we have on that survey is actually around - Who should we link people to? So I'm sure you could think of some support groups, numbers that people can call, and we will absolutely make sure that people are well supported through this application. It might even be that you can think of not just health information but say GMET online resource is that they would like people to know about, and it might be that we can link people to more information. I'm sure not everybody is going to be keen to learn about ozone and air pollution, but for the people that are, it's really important that they have that option. Another point that's raised from the little survey that we did, is around helping people to understand that their health outcomes are complex. So S was saying that it's quite important but people to know that issues are multifaceted, and I think that's a really good point. So I wonder about including messaging there that is about - Do you know, many things impact your health, one of them is atmospheric conditions. So it's not a doom and gloom horror Story where the only thing causing your asthma is the air quality outside. But the air quality is one of the things that influences. There is a comment on the survey about a concern the people might focus in on methane as the only component of climate that's important. It sounds like it's really important to help people understand that it’s not just one factor, and also that air pollution is just one factor in health outcomes. So I would say this feedback to our design and development team, and hopefully what we can do is mitigate some of those concerns.

<Presents on Education Modules> as follows

* The Perfect Storm
* Ozone and Health

Int1: First, we will discuss the evidence based, secondary will discuss Common Knowledge content, and then third we will ask you to evaluate the content that Common Knowledge had prepared for us. Then we will do in evaluation.

<Presents the Perfect Storm slide>

* Ozone occurs naturally in the stratosphere, making the earth habitable.
* ground level ozone occurs in the troposphere and affects the air people breathe, drives global warming and produces health impacts.
* there are no natural sources of ozone in the troposphere, it is produced from interactions between emissions from human activities and meteorological conditions.
* Specifically, ozone is created when hydrocarbons interact with nitrogen oxides and sunlight.
* Nitrogen oxides occur when fuel is burned EG car emissions and commercial, industrial and residential emissions.
* Sources of methane and non-methane volatile organic compounds (Non MVOCS) include vegetation, waste processing, fuel production and combustion.
* Maintain important because it stays in the troposphere for longer than other pollutants - up to 12 years - compared to less than one day to months for NMVOC's.
* While non methane V OCS are more reactive, accounting for a greater proportion of ozone production, methane is more abundant due to its longer atmospheric lifetime.
* Methane is also a major driver of climate change, with 80xs the warming power of CO2 background levels reflect cumulative build up.
* Methane and climate change are linked via a positive feedback loop

<Presents the Perfect Storm slide>

* <Shows image slides for Perfect storm>
* <Evaluation> take a couple of minutes to consider the people in your life who might benefit from the ME-NET application. Do you think the perfect storm module would be easy to understand for those people? Please respond to the brief survey items using the QR code.

<F joins the group>

Int1: There are so many good points being made here. The first comment is using a voiceover for visual impairment to improve accessibility. A question I have for people actually is for visual disability and including sound, people have mentioned to me before that using videos is a really good idea, but a lot of people's Internet isn't necessarily good enough for using high-powered videos. I'm wondering about sound? Would most people in Ghana on a smartphone be able to play a recoding, like voice over for an application like that? Is that something people know? Could you easily or most phones play something like an auditory recording? Would the Internet support the use of auditory recording to enable vision impaired people to use this application? Does anyone have any thoughts on that? A?

Res1: From looking at some of the folks here at the university, I think they have developed something like an app for people who are you know, visually disabled. So yes, I think devices now could accommodate sound. I know most people know instead of just typing, even WhatsApp will record and just send it, and you replay it back. I know Google Assistance has some of these things done well. We could look at how this is done using Google Assistance. I'm now with AI, I think we can be able to add AI to be able to transcribe what is written into sound, so that others who cannot read, would be able to understand this. The other issue - Are we sticking to just one language, or other plans to do it in some of the local languages, or even French?

Int1: Thank you. I made a note to talk to our design group about embedding AI to produce verbal language. The issue around which language. That was something that we have discussed, and just keeping in mind that this is a prototype, so initially this will be in English. I did ask our team if there was one of the language that might make the application more accessible? A, you just suggested French. Does anybody else have a feeling that the prototype could operate in, or further down the track, if we are able to get the feedback from the prototype and go forward, we then might be able to invent other languages? Is French a language that would be useful or is there any other language that might be say a little bit more widespread in Ghana that would be useful?

Res9: So are we suggesting the French globally, or just for Ghana?

Int1: Just for Ghana.

Res9: I don't think a lot of Ghanaians speak French.

Int1: That's really useful to know. M?

Res8: So for me, what I would like to say is that I think this project has a focus area, especially locations we want to target for now, and that becomes the basis for maybe future expansions. So we need to go co-production, most of us on this course, we need user inclusivity. We want them to use this, for them to share their own experience with us and tell us what they want, and we can combine that with our expert views to develop the project. I think that would be the best way for this discussion, for the best result for us to get. In terms of the languages, we need to consider a local language maybe taking those areas that we're looking to for consideration. If there is a language that is a common one, then we look at that and see how it can be leveraged for other areas. So that's what I would like to say. And also in addition, now it's more about communicating information in the form of impact base. What is the impact going to cause them, what is happening, and people can take action based on that and we need to develop those actions together with the users. I can take for example - What is the extent of how that meeting all those who are talking about, affecting them. If I can see a forecast coming to me, what should be my reaction? What is the degree of impact? I think this is what we need to be thinking of in terms of our discussion. This should tell us to bring on board the users of this information. For the disabled, it would be good to bring them also, have an interaction with them. Yes, maybe a group that can be your voice might be better, but maybe from their own experience what could be more comfortable for them to be able to access this information and interpret it better, and probably try adding audio to those local languages that we're going to be identifying together with the users, will also help. It will also be a form of educating them as you mentioned. Most of these are not just only by natural occurrences, human activities are contributing. If people understand where these sources are coming from, in their day-to-day activity, they need to take some actions to reduce the production of things that are leading to the increase of this ozone methane in the society or community. I think we will be achieving a great impact. So that's what I'd like to share.

Int1: Thank you, that is a fantastic input and lots to think about; particularly how we can develop with users, and if there are other people that need to be in this conversation where this. E?

Res6: I wanted to comment on the language, but I think that M has done justice to it. So we are good to go. French is not predominantly used in Ghana. We can go for the native language.

Int1: Thank you, so people feel quite strongly about that, I don't wonder particularly if when we visit Ghana, we will be able to get a sense from people of how to make this more relevant, more local, and to capture language in that way. The final comment which quite a few people have made with this survey, is around the complexity of the language, they need to keep it simple, and there are some suggestions on how to address literacy level, maybe using images, related experiences, the need to capture household contributions to methane. There is so much there. Thank you. Education level. What do people think about the idea of using a more image based communication tool? So rather than having lots of words and terms, having images where air pollution comes from, and the sorts of impacts that it has. There might be a need for some minimal text, but it could be quite minimal. So a more pictorial version of that information, is that something that people feel would be more useful?

Res11: I'm just thinking back to the COVID, and the kind of things we did with communities around education and COVID generally. Generally, we had a lot of community engagements and animations around the language the language and the audios and the pictures. It's a combination of all of what you've just mentioned. Context really matters, depending on the audience that we seek to influence, so it's a function of your audience. So once you know your audience and your target, then you are able to pull through the mix; that really has impact. I have also been observing a certain trend where we are already in communities doing a lot of work around air pollution. Currently in some of the areas that I work in, we're beginning to have a lot of education and capacities and campaigns and pictures around air pollution. Now we include methane and then it becomes very complex for community people to appreciate. And so I'm just wrapping my brain around how all of this conversation our methane and air pollution, the particles and all those scientific terms that you guys load on us in the communities. Maybe I can't do that here, but maybe we need to be a bit measured in how we integrate some of these interventions on the ground, so that it doesn't become too heavy for communities to digest and use. My last point is on the agency to act. It's not enough for residents to know that methane is emitted through the sun and blah, blah, blah. It's also about - What can we do as communities? What is the agency to act? So if you just create the urgency and the fear and the importance of methane and gas and blah, blah, blah, and you don't really empower people to change what you are asking about, then it becomes a bit unattractive. My question is just to reflect on these three.

Int1: Thank you. That is a really good point. Earlier on we had a bit of discussion about embedding into this application health protection support networks that are local and relevant to people, so if they are receiving an alert about ozone levels, and they are educated about ozone levels, then – What can I do to help? What can I do to support myself? So that might be one option. The question about what people can do about their own environments, possible field work in Ghana will be gathering a sense of understanding about what people want to know, what sort of solutions people want. So I would be really interested to learn about what you have to say and the people that you represent. S, I've just put in the chat here that the population is very heterogeneous. So for example in Accra, Internet service is good and videos may work, however outside of Accra, audio might be a problem. So ideally you would want different versions. I think that is a really good idea. I'm going to make a note for different accessibility versions. It might be for example, that you can switch on or off different versions. And that's something I need to ask our design and development team about because I think it's a fantastic idea. OK, there are so many comments in there, I'm going to have a lot of fun reading through all of that. Someone said that the Internet tripped so they didn't hear much on methane unfortunately, that sums it up doesn't it in an ironic way! That we need different options, so that message loud and clear, thank you. We will move on briefly then to the health aspect of this. What we have to show you is some information and some visual content about ozone and methane, and the message that we were getting from you, is this might be a little complicated, and what we need to do is really think about how this new information will interact with the information that people already have, and what effect that's going to have on people. So keeping all of that in mind, we would also like to educate people about the effects that ozone has on their health. What we're going to have to do is take on board all of those messages that you've already told us. Things like - What should I information look like? Could we be producing fear? How can we link people to useful information so if we are concerned about their health, so they have options? What kind of information would be beneficial to people? So we put together a little bit of information here. This information is largely for our own understanding, so J and I did some research, and we're going to feed some of that information back to you about health outcomes. How much of this information is important to people, is a different story, and something I would really like you to think about his health protection, particularly around COPD and asthma, that sort of thing. What sorts of advice would you give to people?

<Presents ozone and respiratory health slides>

* WHO estimates greater than 7 million deaths per year from air pollution.
* Deaths attributable to ozone specifically during warm periods across Europe between 2015-2017 was > 100,000(Achebak et al, 2024).
* As soon as associated with approximately 0.7 million deaths per year, on average 6.3 million years of lost life related to cardiovascular and respiratory illness (Aneburg et al 2010).
* Long and short term exposure decreases lung function, particularly for children) Holm and Balmes, 2022).
* Peak daily ozone and ozone in warm months is associated with cardiopulmonary and respiratory mortality.

<Present Mental Health slide>

* Zhao et al (2018) reviewed 31 studies –> Links between ozone and cognitive function, possible links to suicide, depression to ED admission for panic attacks, notably:
* two cohort studies showing association with depression, including increased risk of reporting symptoms per 10ppb ozone exposure, association with them being concentration and suicide mortality in Belgium for all seasons except winter;
* one case control studies showing difference in ozone for days with +2 suicides (x=86.4 ug/m3) and those without (x=79.8 ug/m3)

Mental health research is less clear

<Presents Direct vs Indirect Pathways slide>

* Increasing evidence for direct impacts of pollutants on central nervous system, cerebral white matter, cortical grey matter and basal ganglia (Bernardini et al, 2020b)
* Alterations to brain regions and process is linked to psychopathology EG changes to neurotransmitters (Zundel et al, 2022).
* maybe some direct pathways to? EG possible links between respiratory systems and mental health flare ups/escalations. Biophysical effector blue inhaler salbutamol overuse EG increased heart rate, tremors, stomach acid precipitating anxiety?

<Shows some points to consider slide>

* WHO estimates that dangerous ozone concentrations are greater than 100 ug/m3.
* Thresholds might be low for mental health.
* What are the actual links, drivers and pathways?
* Much more research needed.

<Shows Ozone and your health slide>

* Think about the most important thing you have learned about ozone and health. Which bits are the most important to include an educational module ‘Ozone and your health’? Which bits should be represented visually? <Shares mages designed by Lincolnshire’s University Academy Holbeach in Kings grammar Grantham students> Picture – How bad air things get out.

Int: What is important for people to know about the impact of ozone on their health? Is it important to educate people about this or are we going to scare people? Which bits of this information should be captured in our application to help people understand? If people have views that they'd like to share now, that's fantastic, I appreciate it is a lot of information, there will be opportunities in the follow up survey as well to capture some of this. If there are any views that people have, what bits of information on the impact of ozone and your health do we think are most important to capture for education? S has commented – for inhalers, overuse of salbutamol, only is linked to death but not to other inhalers as far as I know, which is why now according to the guidelines, no one should be on salbutamol alone, I'm concerned about the term inhaler, and anyone getting asthma care should not be on salbutamol alone. So a question that I have for you S, actually in the UK when we say blue inhaler, that is for people to manage an acute respiratory attack which is salbutamol. But the brown inhaler, is the preventative steroid that people take in the morning, so I'm wondering if it's the same, that difference between the blue and the brown inhaler? Is that the same in Ghana, or is that different and would that be a useful distinction to make? While I'm letting you respond to that, I can see that S has his hand up, S?

Res2: My comments relate to your question on whether it is important unnecessary for people to get to know about the ozone and health, or methane and health, a sensually this question relates to any projects on health, for that matter, projects that we intend to use mobile apps or websites as a delivery point. So for me, it is not just a matter of knowing and maintaining health, but importantly it's about what to do. - OK, what do I do next? I know for example that methane can impact let's say on my physical health, but also on mental health, although the link is not clear yet. If I know the concentration of methane in the environment, and my app is telling me that it's pretty high, what do I do next? And to me, that is the most important thing. If people don't know what to do with the information that they're processing, then we are going to increase their anxiety and make them more devastated with the information that they're consuming then before. So to answer that question, yes it's good to know the solution to address the issues that people are confronted with. How would the app help me mitigate and it just to adapt to the impact of maintaining the environment or the zoning environment. So this is the discussion point that I think we next need to have. But of course, it is necessary that we know what we do next if we know. Thank you.

Int1: Thank you, S. That's a really good point. It's interesting that it's one that we keep coming back to, which means it's really, really important. We need to think about – Ok, now I know, what do I do next? So that's something we will continue to keep in mind. And there will be an opportunity in this following survey for people to actually say – Yes, I know some health services that people should be linked to, and this is information that should be embedded into this application. I'm hoping that we will also have the opportunity in Ghana to get some feedback from people. F?

Res11: I'm just writing on the back of my colleague who just spoke, one of my concerns is also about the possibility of having a perception survey. What we normally would do in a typical informal settlement would be to begin with their perception survey just to appreciate what people know, their attitudes, their behaviours and practices. So whilst we do the perception survey, we get to know what they know already about methane, the environment, pollution and all of that. That becomes a very useful starting point for even developing all of these messaging and all the types of intervention we want to do. That's one of my core reflections on that. The second one has to do with how to measure methane. I want to believe that we are discussing using equipment: gadgets, scientific gadgets. Is that the conversation?

Int1: Yes.

Res11: So this project would provide some equipment to scientifically measure the levels that are tolerable and the levels that are not tolerable. I remember in my current programme on air pollution that we are running, the community will ask you – Ok, I live in an informal settlement, I live near the dump site, and I can tell that the smoke and all the things that I am seeing is poisonous to my health because they suffocate when they breathe. However, they will still tell you that - What can I do? How do I change the pollution in my area? You talk about indoor pollution, and they tell you – Ok, I'm using a fuel that is not clean fuel, are you willing to provide clean fuel or clean stocks and me? And so for me, given my role of dedication for knowing the health impacts of methane, it's very, very useful, if we are able to link that with the economics of the day, how it affects people's lives now you have to spend money at the hospital and how you the health bill increase and how you will lose a piece of work. These things resonate faster with them, with my people, when you begin to quantify or translate the health impact into economic losses, remember, most of us would say that we are to make a living and not to change the environment. So when you are able to link the messages to economic losses, you begin to shape people around you on your side.

Int1: Thank you, really insightful. I have to say that I'm sure there are ways of measuring local methane emissions, but we should have a chat another time about the methane measures that we actually use because there are a number of ways of measuring methane, and one of those ways this is using satellite data actually. So there are other types of data that we use, but my understanding is you can locally measure methane with certain sensors, and that is something that I would like to look into, particularly for future bids to try and fund those sorts of sensors for local people's usage and citizen science. So again, that message of – So what, what do I do now? And that is something that we really need to seriously consider going forward possibly could be a central focus of the workshops that we do in Ghana. Hopefully, you can help us decide what we should be doing in those workshops based on your own experience, having done stuff like that before. This has been such a fantastic session. And I've learned a lot about the challenges that we face and delivering the health protection in Ghana.

<Displays Follow up Survey Screen>

- Find out more: your ideas about the links we should embed in the app.

- Opportunity to recommend additional stakeholders for the board.

- Days of the week/times of the day for future meetings.

- Further opportunity for feedback and input.

<Meeting Transcription>

- All recorded meeting will be transcribed.

- Transcriptions will be uploaded to Teams.

- Opportunity to feedback.

<Displays Future Meetings slide>

- Similar format, feedback and Co develop content for the application following the themes below

- Timeline for future meetings

<Future Themes>

- Visual self-assessment tools for MH and respiratory symptoms

- Graphing self-reported data, alert me

- Mapping observational data, explore and learn

- Prototyping functionality of alerts of the system/app

<Displays Thanks for Attending slide>

Int1: If anybody has anything else that they would like to raise, please feel free to contact us. Thank you so much for attending. This has been a fantastic opportunity to chat to everybody and I really appreciate all of your time more than anything, and your expert advice and input. That's all for most come out we will be following up with this survey, and just thank you so much for your time.

Interview Ends