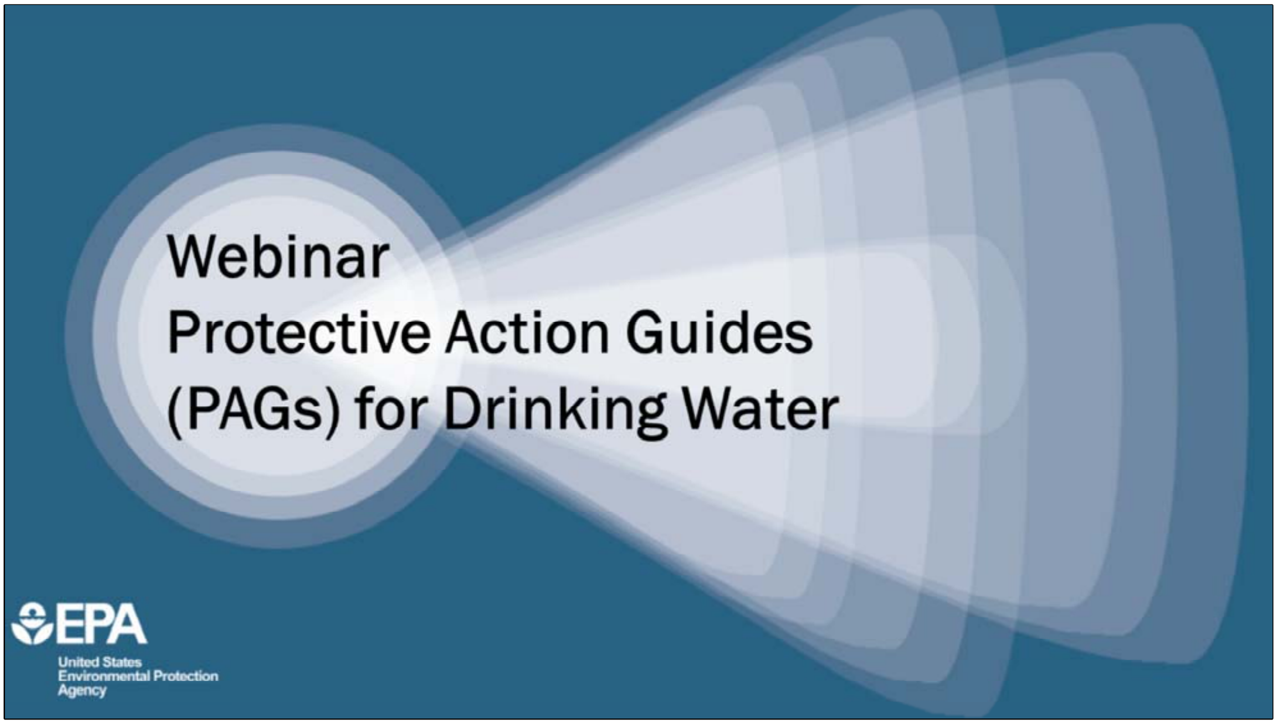
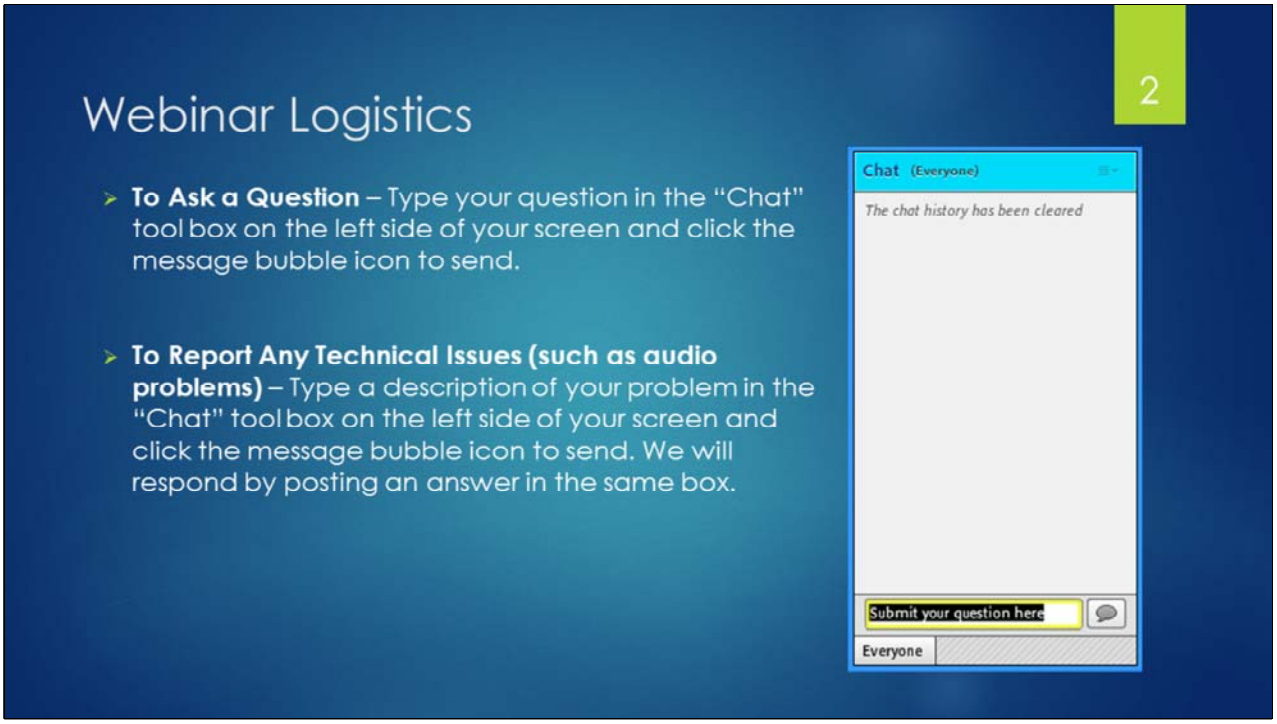


Welcome to the Webinar on Protective Action Guides for Drinking Water.

I will discuss the protective action guides right after we cover some logistics and housekeeping information

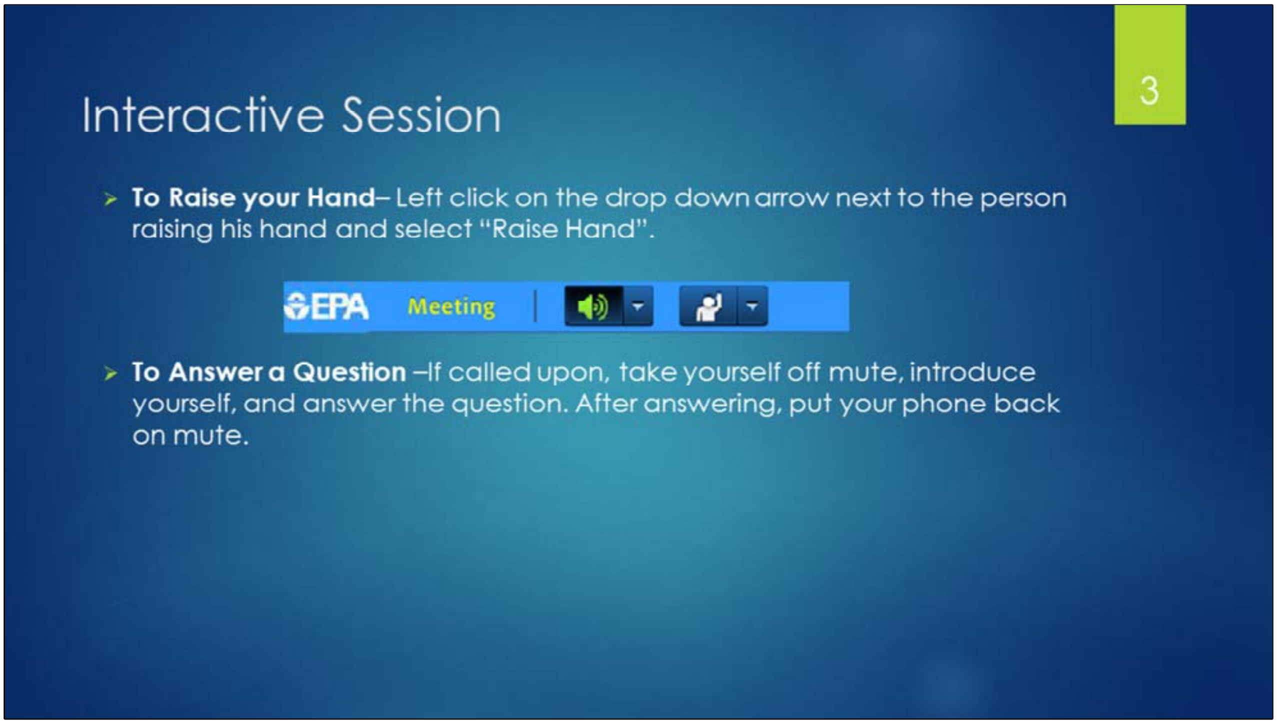


We are using EPA's Adobe Connect service for today's webinar. You should be able to see the presentation on your screen now.

We ask that all participants who choose to call into the phone line also mute their computer speakers to avoid an echo. We encourage you to submit your questions throughout the presentation. All questions from today's webinar will be collected and answered. If we are unable to respond to your question during today's live webinar, we will compile your question as well as others and respond to all questions as part of a FAQs.

If you experience any technical difficulties during this webinar, you may type a description of your problem in the "chat" box on the left side of your screen. Make sure to click on the chat icon to submit your question. We will respond to your question in the same "chat" box.

This is going to be an interactive session. To practice using the chat box, please type in the group or organization you work with. Excellent… I see that we have people from OCSPP, Region 1, ORCR, etc._(EXAMPLES).

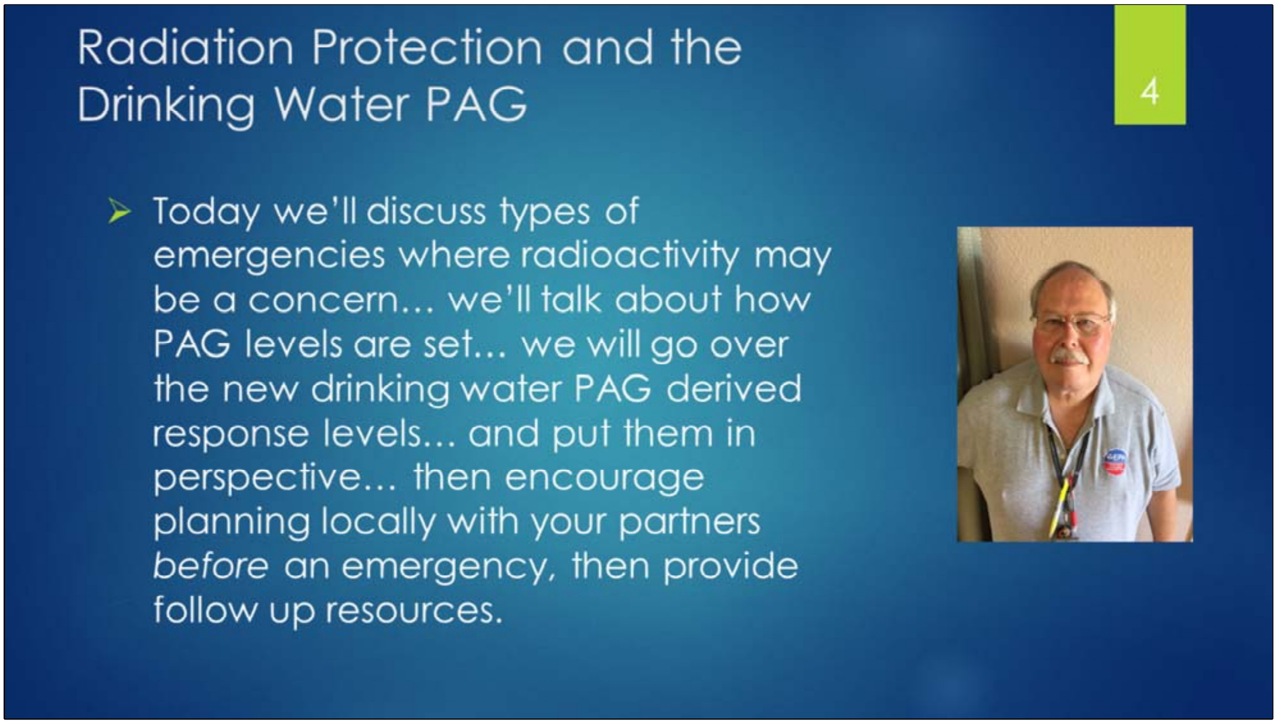


Because this information can be very important during an emergency, I want to make sure you are paying attention and understanding what I am telling you.

We have one more thing to practice. Across the top of your screen you will see a raise hand button, as part of the header bar (a screenshot of the header bar is shown on your screen if you need to orient yourself). In the header bar left click on the dropdown arrow and select "Raise Hand". You can also lower your hand. We will be using this throughout today's course. If you see this button, **EVERYONE** please go ahead and raise your virtual hand **NOW** [Address anyone who does not have their hand raised] This way I know can check in throughout the presentation.

Let's get started.

So there are no surprises, I will be calling on people and asking for volunteers to answer questions throughout the presentation. If I call on you, please take yourself off mute, introduce yourself by name and organization and remember to mute yourself when you are done answering.

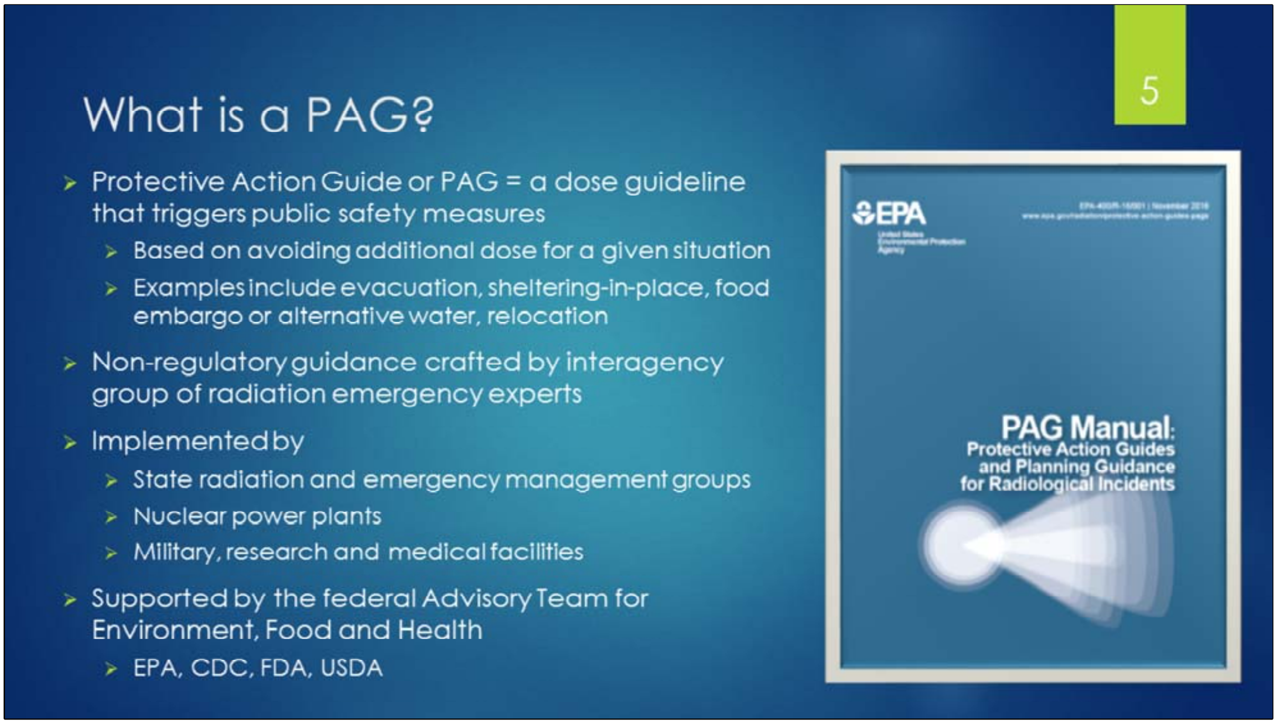


I want to take a second to introduce myself. That is a picture of me on the bottom right of your screen. My name is George Brozowski, the Regional Health Physicist from the Region 6 office in Dallas, TX. I have been in TX for the past 19 years, having moved from our Region 2 office in NYC. You can tell where I got my Texas accent!

Let me get a show of hands… How many of you are involved in drinking water safety either from a day-to-day or emergency response perspective?

<<Presenter to call on someone who raised their hand>> I'm going to call on….name] In a sentence or two can you describe your role in protecting drinking water?

Thank you.



We are all here today to learn about EPA's drinking water protective action guides – or PAG for short. But what is a protective action guide?

EPA publishes the Protective Action Guide Manual (which is that picture on the right) that contains dose guidelines that would trigger public safety measures to minimize or prevent radiation exposure during an emergency. Each PAG's dose guideline can serves as "health-based tipping point" that assists officials in deciding when it is necessary for people to evacuate, stay inside, issue a food or water advisory, or take other immediate steps to safeguard health during a radiological emergency. Let me repeat, PAG is only used during a radiological emergency!!

The protective action guides provide general guidance to officials, which they can use together with their knowledge of local conditions, to make safety decisions.

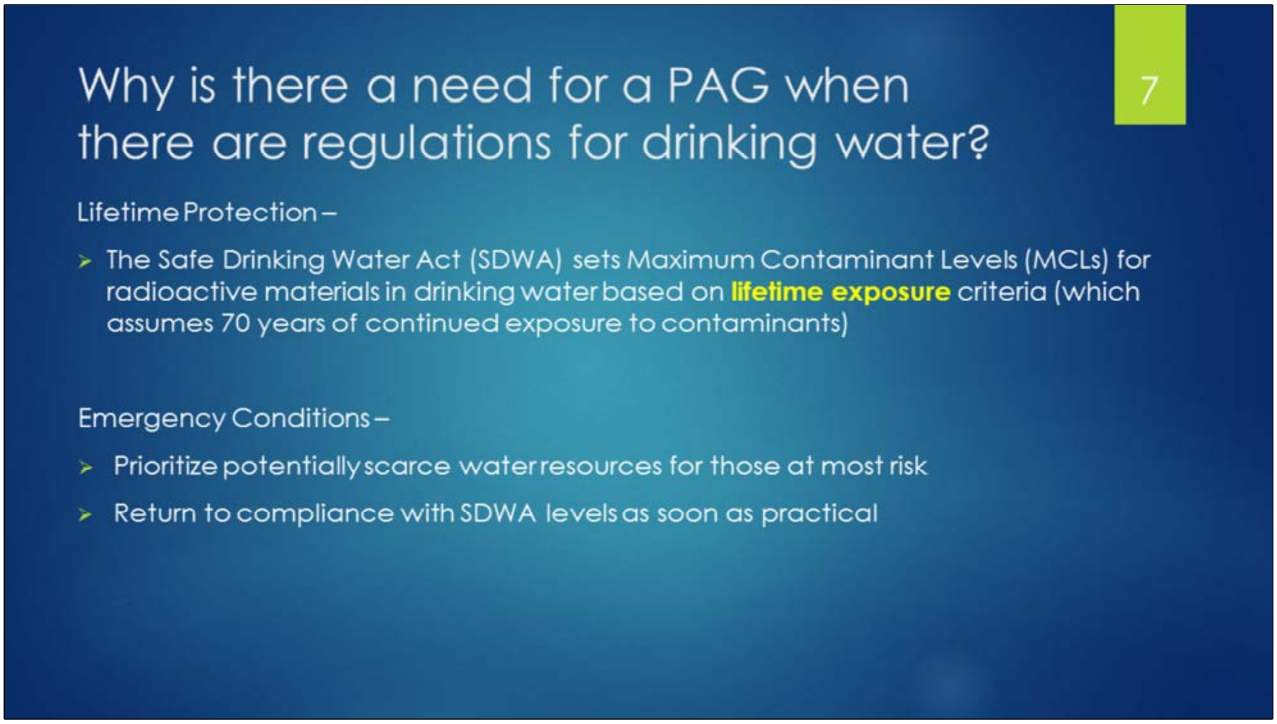
PAGs have been incorporated into all of the state and many local and tribal emergency plans in some form. States, local and tribes governments have the flexibility to make their own plans and PAG levels. Around nuclear power plants, there are Nuclear Regulatory Commission and Federal Emergency Management Agency requirements to use something like PAGs to inform offsite emergency response.

There is a lot of information in the manual and we encourage anyone in radiological emergency response to use the PAGs when planning for an emergency. When it comes to implementing the guidance during an emergency, there is a federal group of radiation experts that can support state and local governments in the implementation of the guidance. They are federal experts from the Environmental Protection Agency, the Centers for Disease Control and Prevention, the Food and Drug Administration, the U.S. Department of Agriculture. They are known as the Advisory Team for Environment, Food and Health, or the Advisory Team for short.

Emergency planners should be prepared to apply PAGs to a wide scope of facilities and circumstances; and to project doses that may trigger the need for protective actions from a release of radioactive material.

The PAG manual was developed to help make timely and effective decisions for dose avoidance by providing background information and relevant guidance under one cover for decision-makers and their supporting staff.

Radiological incidents like Three Mile Island, Chernobyl, and Fukushima all demonstrated important turning points for improvements in preparing and responding to radiological emergencies. Unpredictable events such as a terrorist attack, coupled with unpredictable locations of radiological events make advanced planning challenging. For example, a dirty bomb (which is a conventional explosive that includes a source of radioactive material) could detonate anywhere and spread radiological contaminants across a vast range of surfaces and terrain.



Under the Safe Drinking Water Act (or SDWA), EPA established a dose-based Maximum Contaminant Level (or MCL) for radioactive material based on lifetime exposure criteria, which assume 70 years of continued exposure to contaminants in drinking water. The MCLs were developed into the Radionuclides Rule and the rule only applies to a particular class of public water systems regulated. Those systems are Community Water Systems. **CWSs** are those water systems who supply water to residents year-round, such as a large city or town where people use the water in their homes.

During the development of the drinking water PAG the Agency determined that it is not appropriate to base response measures during short-term emergency incidents on lifetime exposure criteria. We know that MCL's are meant to protect a person over their lifetime.

Let me give you a scenario – A radiological emergency contaminates a drinking water source. The drinking water results are above the MCL. Would you know at what point above the MCL that you would need to start providing alternative source of water for protection of public health? Again – let me repeat the question again: Raise your hand if you would know the drinking water radiation testing results that would require you to provide alterative water.

Assuming a small number raise their hand: For those of you that know, that is wonderful. For those of you that don't, the drinking water protective action guide can help you plan for that.

While the SDWA framework is appropriate for normal operations, it does not provide the necessary tools to assist emergency responders with determining the need for an immediate protective action (such as 'do not drink orders') when a MCL is exceeded. The goal is to prioritize potentially limited water resources for those most at risk in a disaster response.

Regardless of the cause of an incident, EPA expects that any drinking water system impacted during a radiation incident will take action to return to compliance with the Safe Drinking Water Act levels as soon as practical.

Everyone, in the chat **box name a type of radiation emergency where the normal Safe Drinking Water act MCLs might be exceeded?**

I see that some people said....
-Nuclear Power Plant Emergency
-Dirty Bomb
-Nuclear Detonation

Good answers

I am looking for a volunteer: Who wants to take a guess at what I mean when we say that the drinking water protective action guide is non-regulatory guidance?

(note to presenter: talk about the volunteer's response)

All of the guidance in the Protective Action Guide Manual is exactly that… guidance for state and local and utilities to use for emergency situations only. Again, let me repeat myself because this is important: PAGs are use for emergency situations only. And they are EPA's recommendations only; they are not required by the EPA.

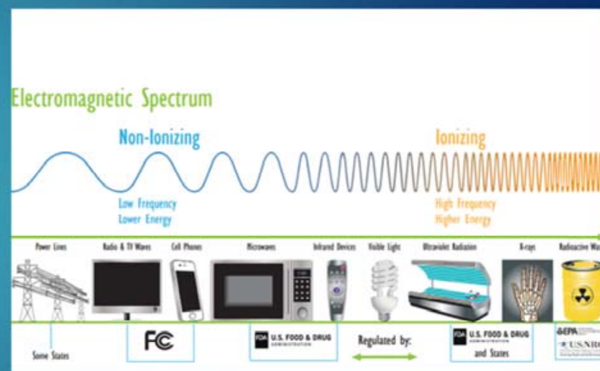
While the drinking water PAG is a non-regulatory guidance for emergency situations only – as I said earlier – drinking water facilities are expected to take action and return to compliance under the SDWA Maximum Contaminant Levels (MCLs) as soon as practicable – certainly within the first year after an incident.

I say this with a bit of caution because some Community Water Systems (CWSs) may be on reduced monitoring and not have adequate treatment installed based on their historical monitoring data and proximity of their water source to a nuclear power facility. But again, that would be regulatory decisions under the SDWA and not related to the PAGs.

Key Terms & Concepts

9

- Radiation
  - Radiation represents energy given off by unstable atoms as they transform into more stable atomic forms.
  - The energy given off during an atom transformation is released in the form of electromagnetic energy (energy waves) or fast-moving particles (energy and mass).
- Types of Radiation
  - Non-ionizing –
    - not enough energy to break molecular bonds or remove electrons from atoms
    - Microwaves, Radio waves, infrared, visible light
  - Ionizing –
    - enough energy to break molecular bonds and remove electrons from atoms
    - Alpha particles, Beta particles, Gamma rays

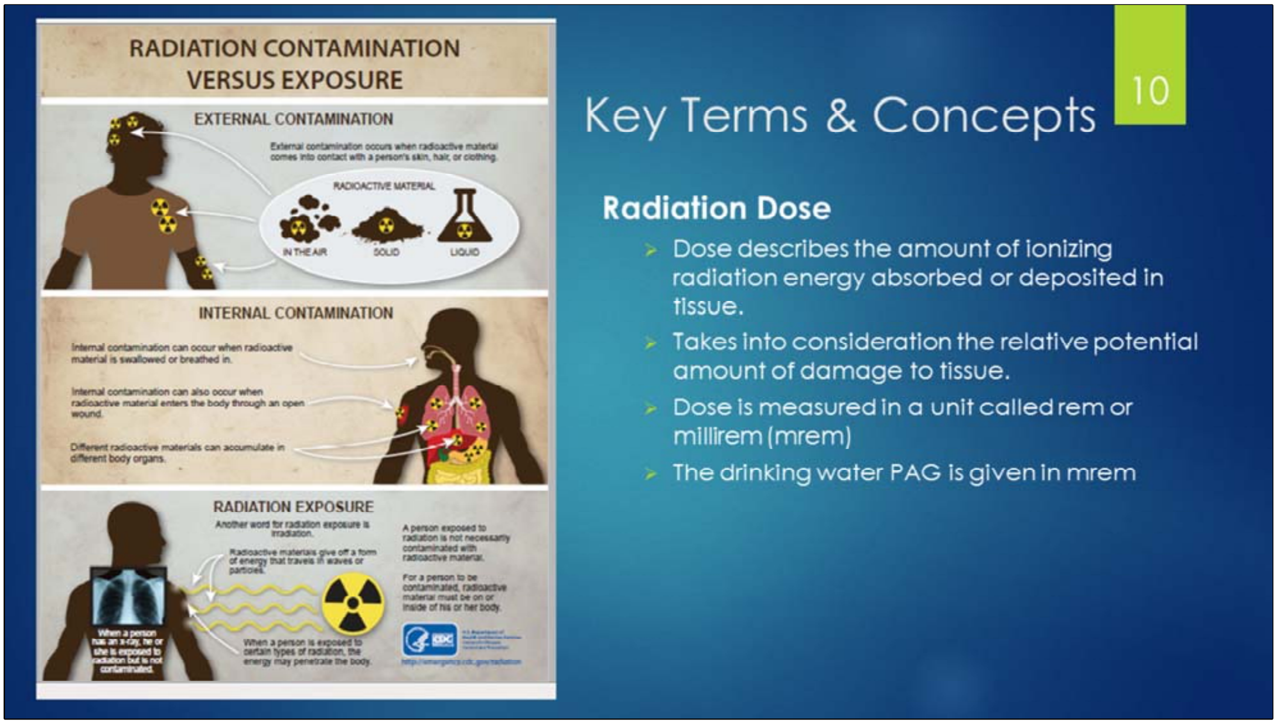


I am not here to give you a masters course in radiation, but there are some terms that I think it is important for you to know in order to understand why we have guidance and what that guidance means.

We're focusing today on Ionizing radiation. Ionizing radiation has so much energy it can knock electrons out of atoms, a process known as ionization. In other words, ionizing radiation can pose a health risk by damaging tissue and DNA. When we talk about radiation from nuclear power plants or terrorist incidents, we are talking about ionizing radiation. Ionizing radiation cannot be produced by a microwave oven in your kitchen. So when you say let me nuke this hamburger, you are heating the food with non-ionizing radiation.

Raise your hand if you agree with this statement- All people are exposed to radiation all the time

[Assuming people raise their hands] Correct. Radiation is also naturally occurring – it comes from the soil and outer-space. Not everyone knows that we are exposed to radiation all the time, and most people find radiation very scary.
It isn't surprising to think that during a radiation emergency, people will want to know that their water is safe to drink.



And radiation can interact with our bodies in a couple of different ways:
It can physically be in or on our bodies:

External contamination is when the radioactive material is on our bodies
Internal contamination is when the radioactive material is inside of our bodies.

I’m going to call on someone from our audience to answer a question:

<<Presenter to call on someone>> [name] – contamination from drinking water – is it external or internal contamination?

Good answer. This is a bit of a trick question – In the U.S. we tend to use our drinking water for activities such as showering, bathing, and washing dishes (external contamination); however these activities represent a smaller risk for exposure as compared to direct ingestion of contaminated drinking water. So when we talk about the drinking water guidance, we are only concerned about internal contamination.

The amount of radiation energy absorbed by our bodies is described as a person’s dose. Dose is measured in a unit called rem or millirem. The drinking water protective action guide is given in millirem.

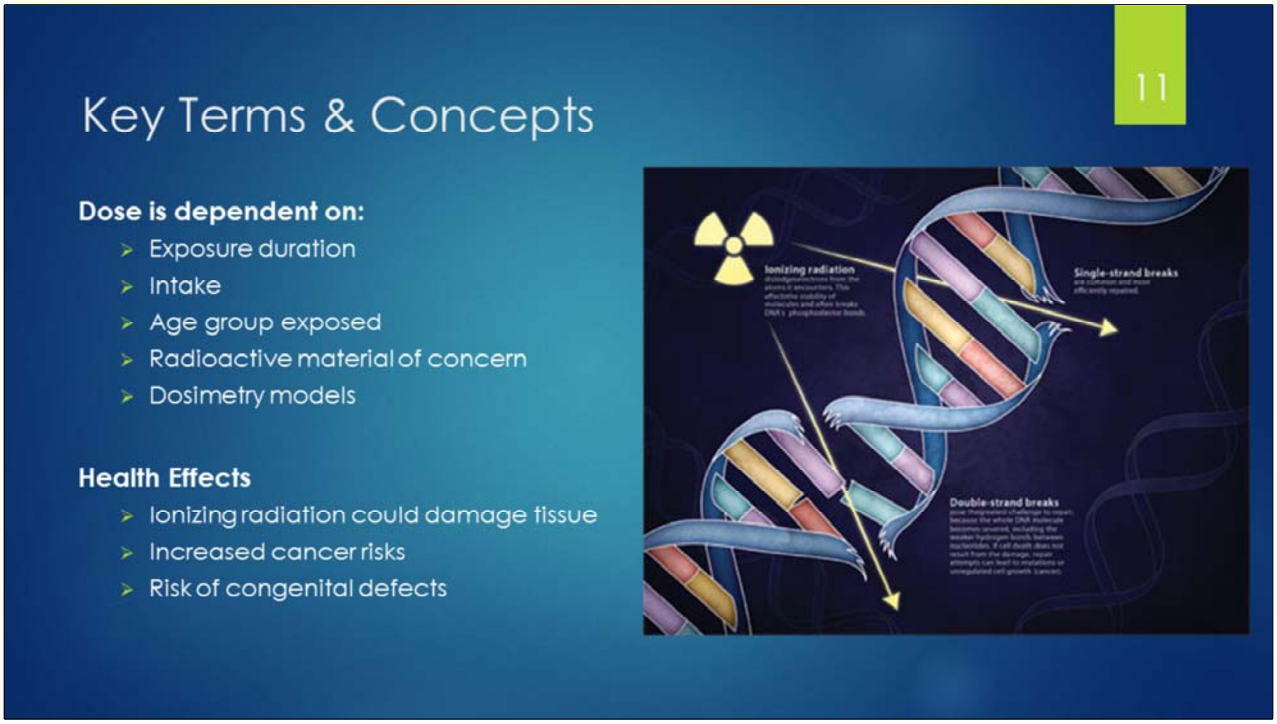
At the bottom of the picture on your screen you can see that radioactive materials release radiation in the form of particles or waves, which interacts with our bodies. When radioactive particles interact with our bodies it is called being exposed to radiation.

I have another question for everyone: Do you agree or disagree with this statement - If you are exposed to radiation that means you are contaminated. You can use the ‘agree’ or ‘disagree’ choice from the Raise Your Hand drop down, or type your answer in the chat box.

Let me repeat the question again: Do you agree or disagree with this statement - If you are exposed to radiation that means you are contaminated

Correct, You can be exposed to radiation – say from a radioactive source on the ground emitting gamma rays, but you are not contaminated because the material isn’t on your body.

As **<< presenter to call out the name of person called on earlier>>** [name] just said – with drinking water we are concerned about internal exposure.

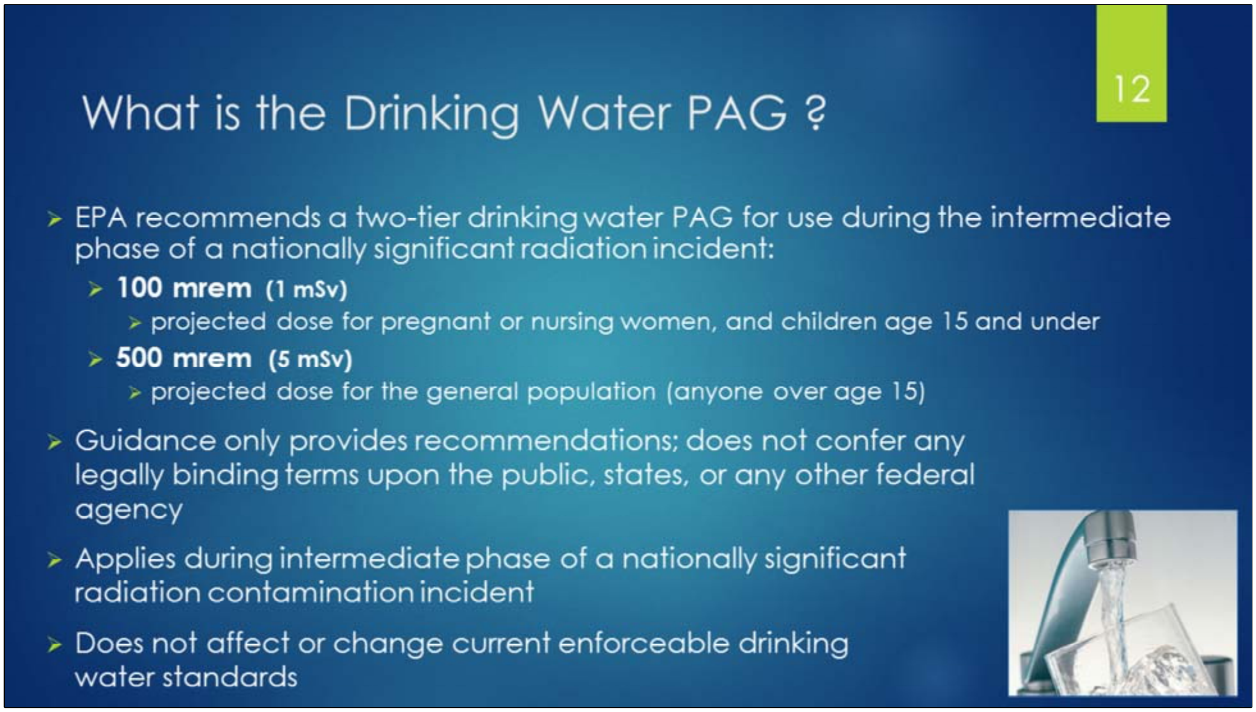


There are a lot of factors that go into determining a person's dose. The type of radioactive material, how long you are exposed to that radioactive material, and how old you are when you are exposure to the radioactive material.

And, there are potential health effects associated with radiation exposure – like cancer – this information isn't here to scare you, but we want you to understand that dose depends on a lot of different factors.

EPA's mission is to protect the public's health, so the PAG levels are very conservative to achieve that mission. Even though studies have shown that there can be health risks from very low doses, there is very little immediate risk of illness or adverse health effects when consuming drinking water that may **contain low levels of radioactive material.**

Health effects associated with higher doses over a long period of time may include cancer, congenital defects, precancerous lesions and benign tumors, and changes to the skin.



Now we are going to focus on the drinking water PAG. This is new guidance to the PAG manual. We received more than 60,000 public comments when this approach was proposed in 2016.

Please pay attention – Now we are talking about the drinking water PAG – and I want you to remember this:

- EPA recommends a two-tiered drinking water guide for use during an emergency: 100 millirem for pregnant and nursing women and children and 500 millirem for anyone over the age of 15. <u>These are doses that we want to avoid – not doses that we want the public to get.</u>

Emergency responders and radiation experts have the ability to take radiation readings and project a dose and if we are “predicting” that children, pregnant and nursing women will get 100 mrem from drinking water in the first year after an incident, EPA is recommending that steps be taken to limit that exposure. If we predict that anyone over age 15 will receive 500 mrem in one year, then EPA also recommends that steps be taken to limit that exposure.

So what do 100 mrem and 500 mrem mean? Are 100 and 500 mrem a lot?

To give you some perspective, let me quickly talk about the most common radiation sources we encounter in our everyday life and how much radiation we get from these sources. Sources of radiation are around us, all the time. Some sources are natural and others are man-made.

Natural background radiation comes from the ground, soil, water, outer-space, and is also emitted by all living things.
Man-made sources of radiation comes from medical procedures such as X-rays.

The average person in the US will receive a dose of 620 mrem per year from background and man-made source.

Raise your hand if a dose of 620 mrem sounds bad to you. *(Thank you, please put your hand down)*

If you raised your hand, let me assure you that this dose isn't as bad as it sounds. Recent studies have shown that if a person receives between 5,000 to 10,000 mrem under a short period of time, usually within matter of minutes, there is no immediate health effects.

Remember the water PAG uses 100 mrem and 500 mrem as thresholds. Now compare those values to 10,000 mrem, it doesn't sound so bad now, does it? Especially when we consider that there is no known immediate health effects at 10,000 mrem

I am looking for a volunteer – Can someone tell me why they think the PAGs have a lower dose that we want to avoid for children and pregnant and nursing women?

<<Take response from the audience>>

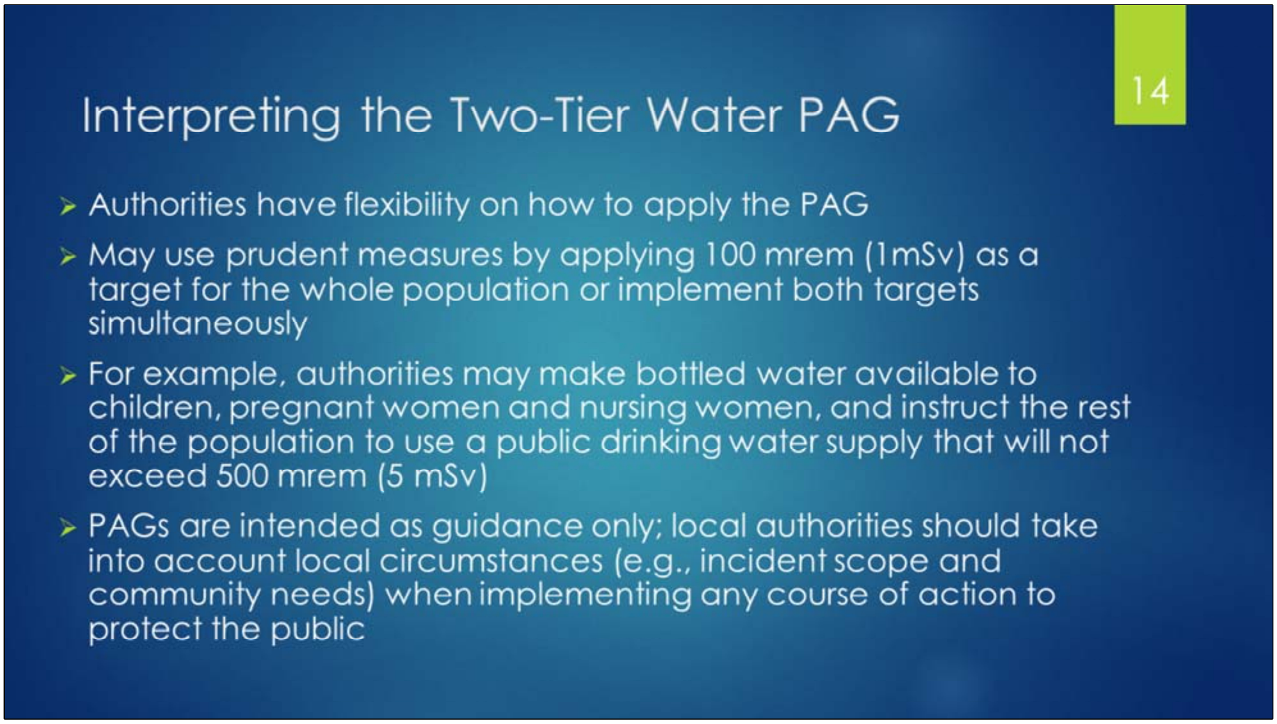
Children are typically more susceptible to the effects of radiation because they are growing so quickly. For example since there is rapid cell division happening in children, there is more of a chance that DNA will be damaged as compared to adults. At that time, there is a greater opportunity to do damage to cells that could lead to cancer later in life.

All Protective Action Guides are created the same way with the same goals

1. Prevent immediate health effects
2. Balance protection with other important factors and ensure that actions result in more benefit than harm
3. Reduce risk of chronic (or long term) effects

The drinking water PAG was developed taking into consideration the risks associated with ingesting drinking water contaminated with radioactive materials and assuming an exposure period not exceeding 1 year.

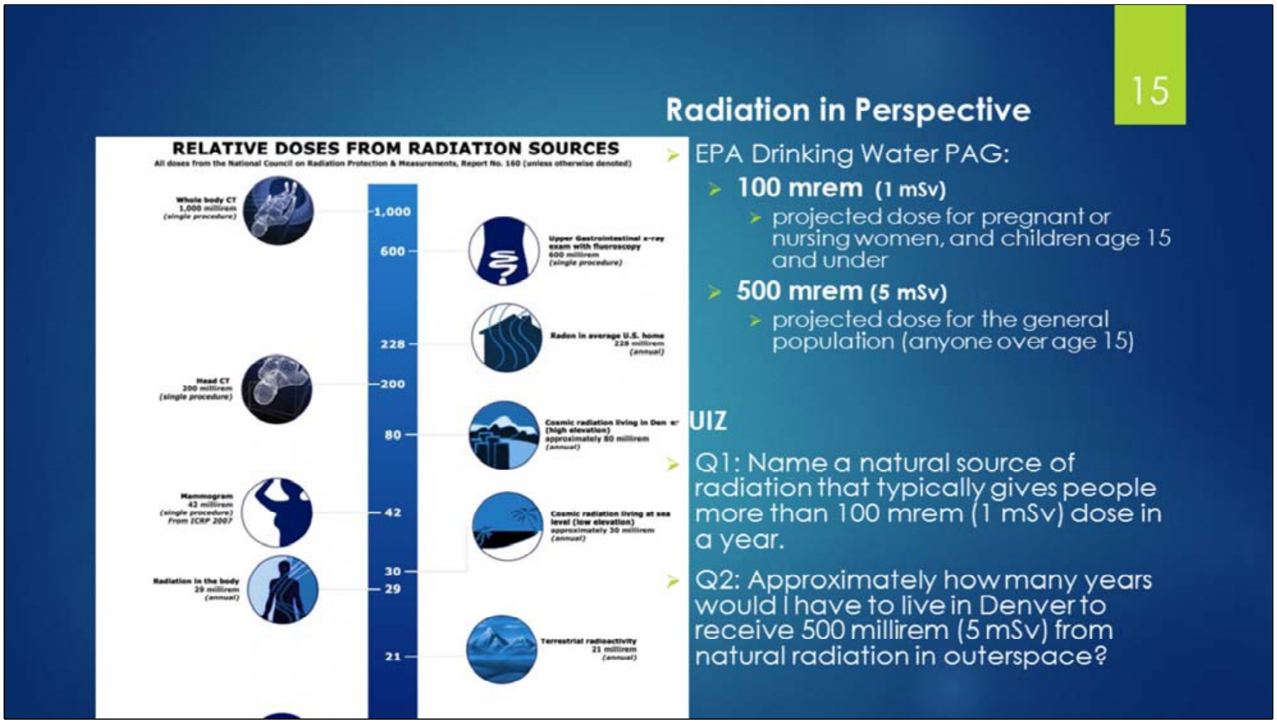
PAG levels result in projected risks which generally fall within the range of risks for lifetime exposure under the EPA's National Primary Drinking Water Regulations for Radionuclides, which are codified in 40 CFR Part 141.66 titled "MCLs for Radionuclides". We strike a balance between risks and actions needed. Drinking water PAGs provide levels of protection consistent with current PAGs for other media in the intermediate phase



Recommending a drinking water PAG and implementing a drinking water PAG are two different things, which is one of the reasons that they are non-regulatory and the reason we stress that states and locals have a lot of flexibility in how they implement the guidance in the PAG Manual.

For public acceptability and ease of application – the states or locals may apply 100 mrem (originally targeted for children and pregnant and nursing women) for the whole population served by the water system. Or, authorities may make bottled water available to children, pregnant women and nursing women, and instruct the rest of the population to use a public drinking water supply that will not exceed 500 mrem

As stated above, the PAGs are intended as guidance only, and local authorities should take into account local circumstances (like the scope of the incident, the community needs, risk of dehydration if it is extremely hot outside, ability to quickly bring in alternative water) when implementing any course of action to protect the public.



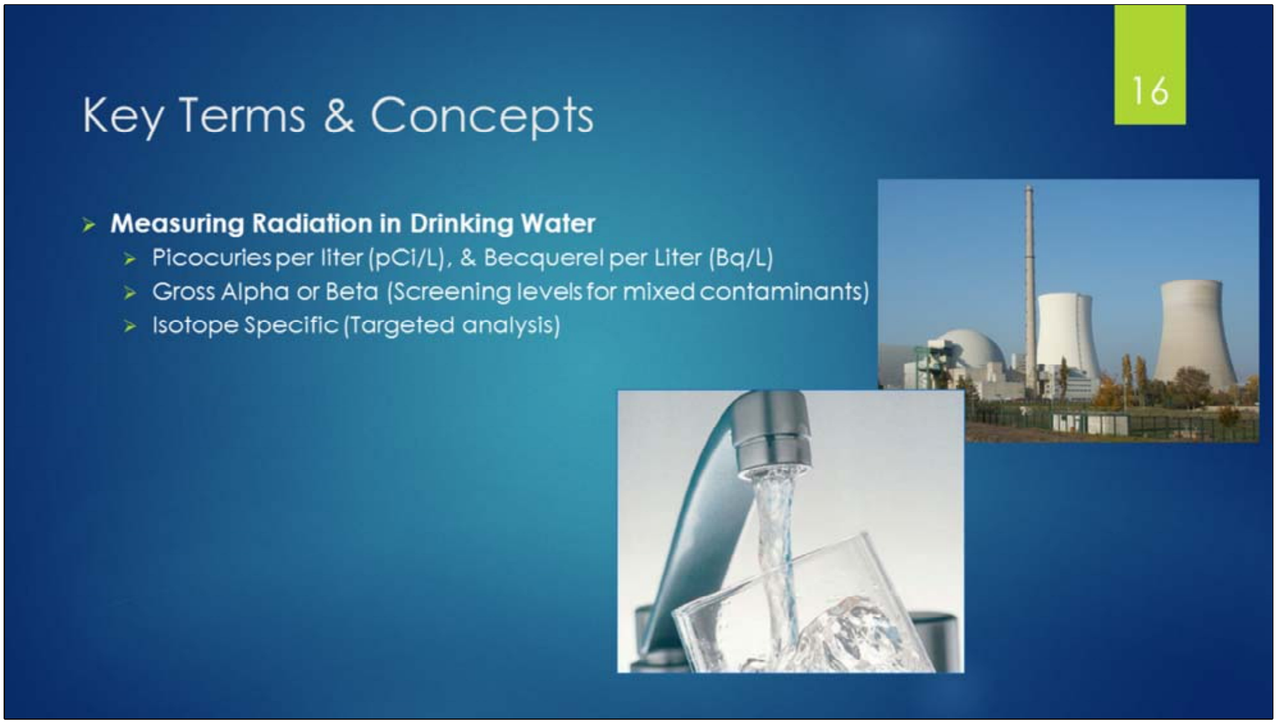
To help put the radiation doses in perspective, First, I can several sources of radiation that typically give people more than 100 mrem (1mSv) dose in a year. Those are a head CT scan, Radon in your home, a fluoroscopy test and a whole body CT scan.

So for those people who live in Denver, {point the mouse/arrow at it} you'd have to live in Denver for over 5 years to receive 500 millirem (5 mSv) from natural radiation in outer space.

Now I'm going to call on a member of our audience to answer a question:

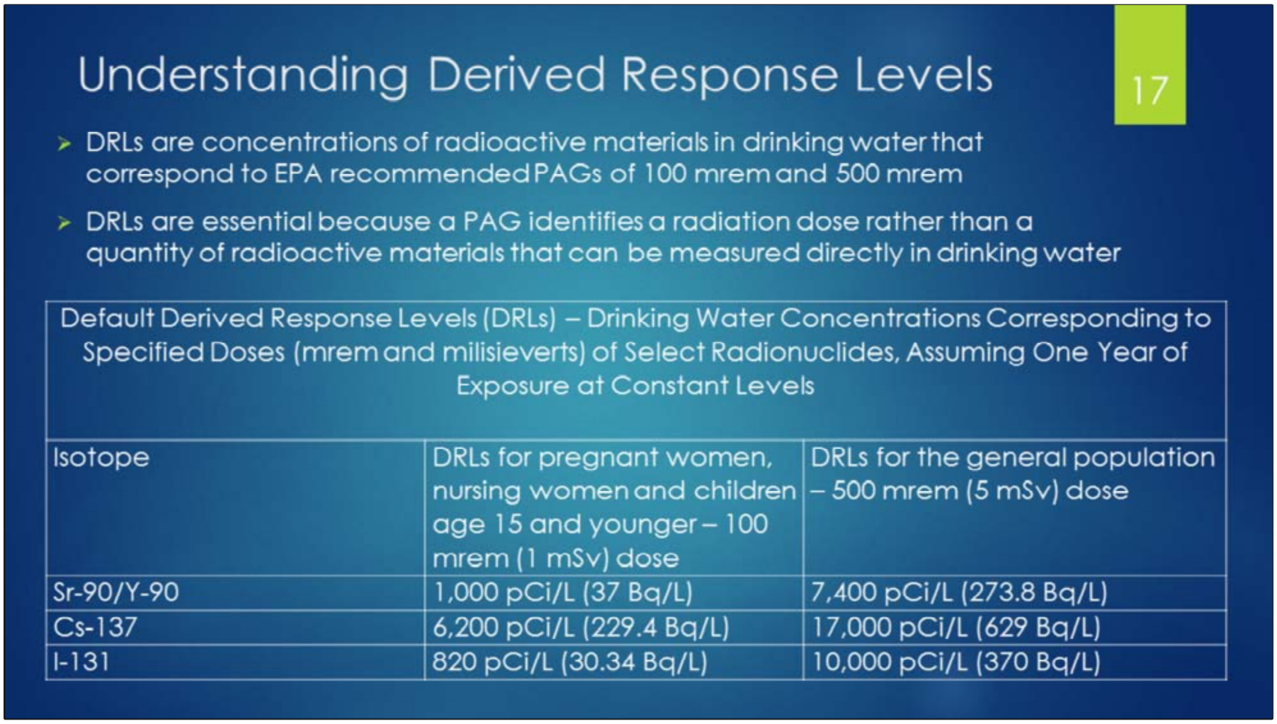
So **<<presenter to call on someone>>** [name], about the radiation dose numbers here – Why do you think I asked you to look at this graphic?

That's a good answer….I wanted to provide you a little perspective: 100 mrem and 500 mrem aren't really that scary when you think about a person's average exposure of radiation in one year of approximately 620 mrem. However, when compared to the drinking water SDWA MCL for gross beta emitters, which is 4mrem/year, of course that makes 100 and 500 mrem seem really scary. No worries though, keep in mind though, that the 4 mrem/year dose is based upon exposure during a person's lifetime (70 years).



The protective action guidance is given in a dose (millirem or sievert) but we typically measure radiation as "activity" in water, given in units of picocuries per liter or becquerel per Liter.

So how do we go from a concentration of picocuries per liter in water to a corresponding dose in millirem or sievert?



Understanding Derived Response Levels

17

- DRLs are concentrations of radioactive materials in drinking water that correspond to EPA recommended PAGs of 100 mrem and 500 mrem
- DRLs are essential because a PAG identifies a radiation dose rather than a quantity of radioactive materials that can be measured directly in drinking water

Default Derived Response Levels (DRLs) – Drinking Water Concentrations Corresponding to Specified Doses (mrem and milisieverts) of Select Radionuclides, Assuming One Year of Exposure at Constant Levels

Isotope	DRLs for pregnant women, nursing women and children age 15 and younger – 100 mrem (1 mSv) dose	DRLs for the general population – 500 mrem (5 mSv) dose
Sr-90/Y-90	1,000 pCi/L (37 Bq/L)	7,400 pCi/L (273.8 Bq/L)
Cs-137	6,200 pCi/L (229.4 Bq/L)	17,000 pCi/L (629 Bq/L)
I-131	820 pCi/L (30.34 Bq/L)	10,000 pCi/L (370 Bq/L)

The information in the table was taken from Table 4-3 in chapter 4 of the PAG Manual.

We use Derived Response Levels (or DRLs) to determine the concentrations of radioactive materials in drinking water that correspond to EPA recommended PAGs of 100 mrem and 500 mrem

Figuring out how a concentration of a radioactive material relates to a dose is not easy and its done on a case by case basis, because every type of radioactive material is different. The numbers you see in this chart are not derived from the same methodology as EPA uses for equivalent concentrations of beta/photon emitters measured in pCi/L that correspond to the MCL of 4 mrem. Keep in mind, as we discussed earlier, the MCLs were developed based on lifetime exposure.

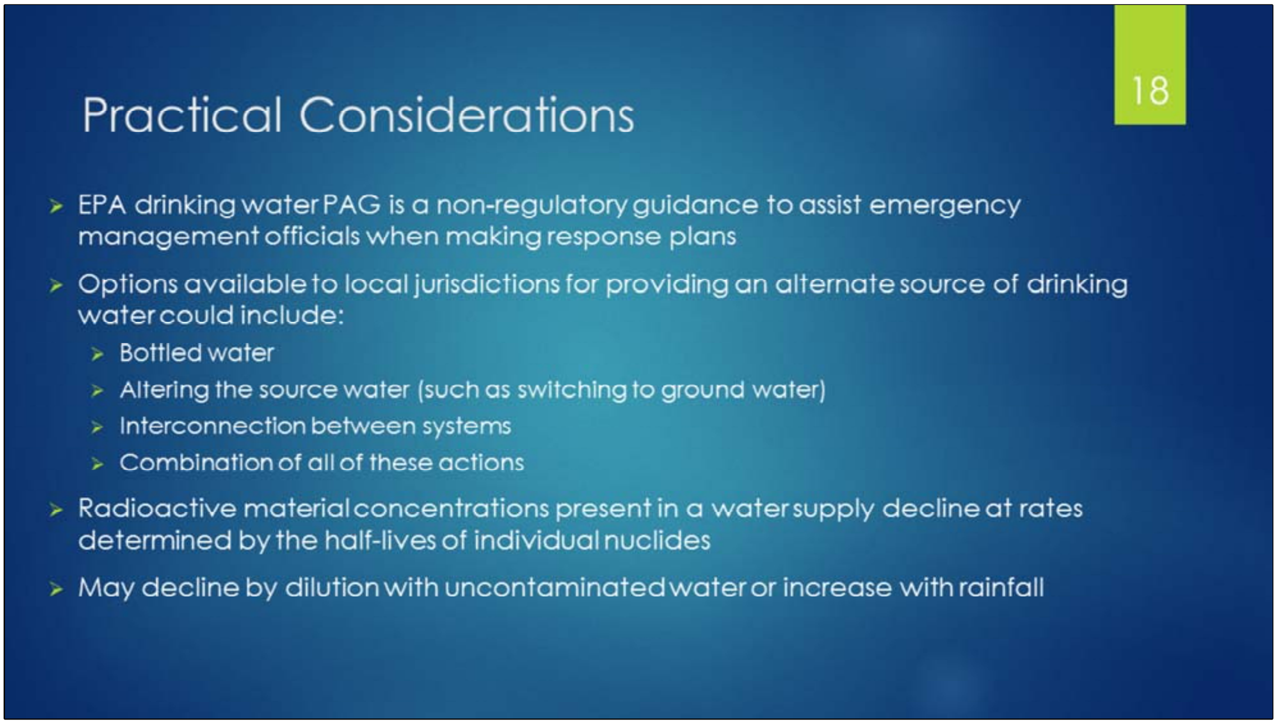
For the PAGs, we focused on establishing dose levels that would protect the most sensitive populations. Remembering that dose is related to things like age, so sometimes several calculations are needed to determine the correct derived response level for the incident. To help, in the PAG manual we included a chart that assumes a constant level of radioactive materials in water over the course of a year… so it does not account for decay over time. What does it mean when we say not account for decay over time? Simply put, the term 'decay' in here refers to all radionuclide will transforms into a different atom, it's a natural process and this different atom is called decay product. The atoms keep transforming to new decay products until they reach a stable state and are no longer radioactive. This decay process helps reducing the radionuclide concentration in water, but we do NOT account in our calculation so we can make our calculation conservative. Not accounting decay product is a very unrealistic assumption, but it help makes sure the DRLs are conservative estimate considering all of the uncertainty.

Again, for PAG calculations, we used the assumption of no decay, which makes the PAG levels very conservative.

For this chart, we ran calculations for Strontium and Yttrium-90, Cesium 137 and Iodine-131, which are of particular interest for major radiological incident scenarios where drinking water sources might be contaminated . We ran calculations for 8 different age groups and selected the most conservative value as the Derived Response Level– for example the 1-year-old who drinks formula might be the most susceptible for Iodine 131.

If no site-specific DRLs developed for a specific emergency, EPA recommends using these Derived Response Levels to allow for the direct comparison between radioactive material concentration in drinking water and dose.

Dose conversion factors, calculation methodologies as well as other comprehensive information regarding DRL development can be located through the PAG Manual. But know that the Advisory Team for Environment, Food and Health can help with drinking water guidance during an emergency.



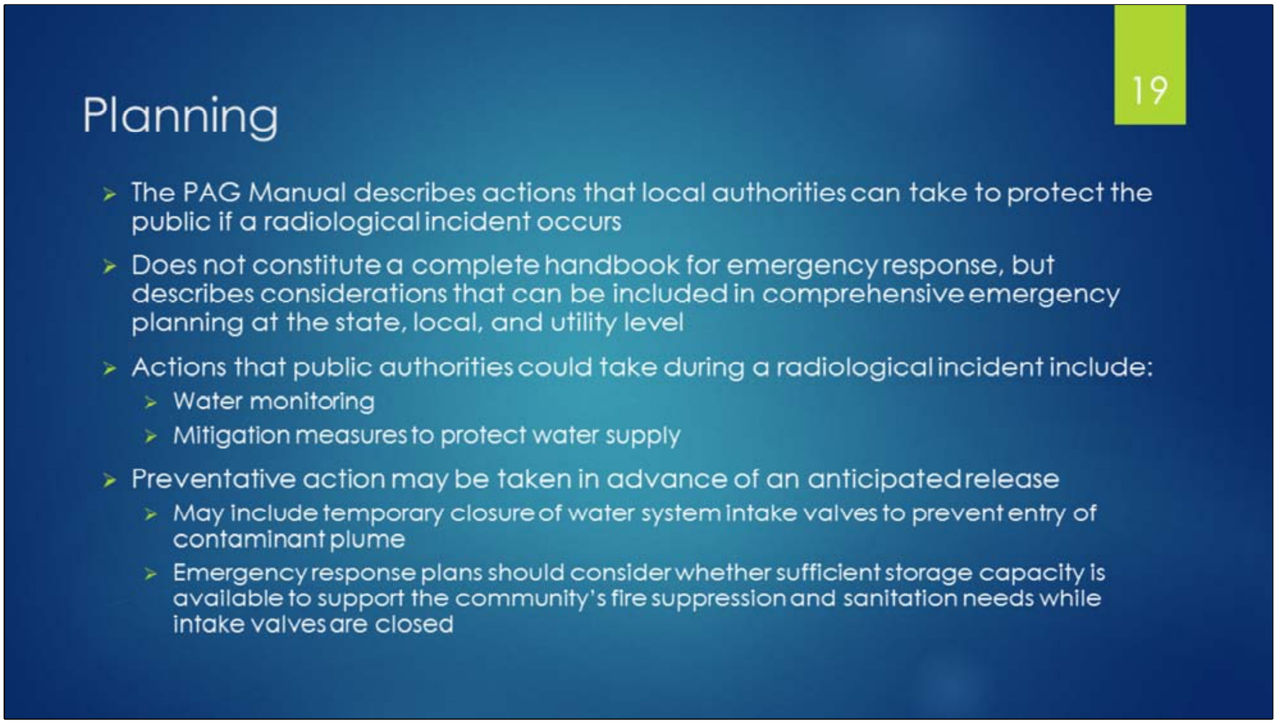
It is important to remember the bottled water is not the only option for providing clean, safe water for the public.

Options available to local jurisdictions for providing an alternate source of drinking water could include:

Bottled water
Altering the source water (such as switching to ground water)
Interconnection between systems or a
Combination of all of these actions

Remember, all radioactive material will decay naturally, and this will reduce the concentration in water.

And even adding uncontaminated water or rainfall can reduce the concertation of radioactive material in water.



You need to plan for a radiological emergency. And no state representative or water utility can do it alone.

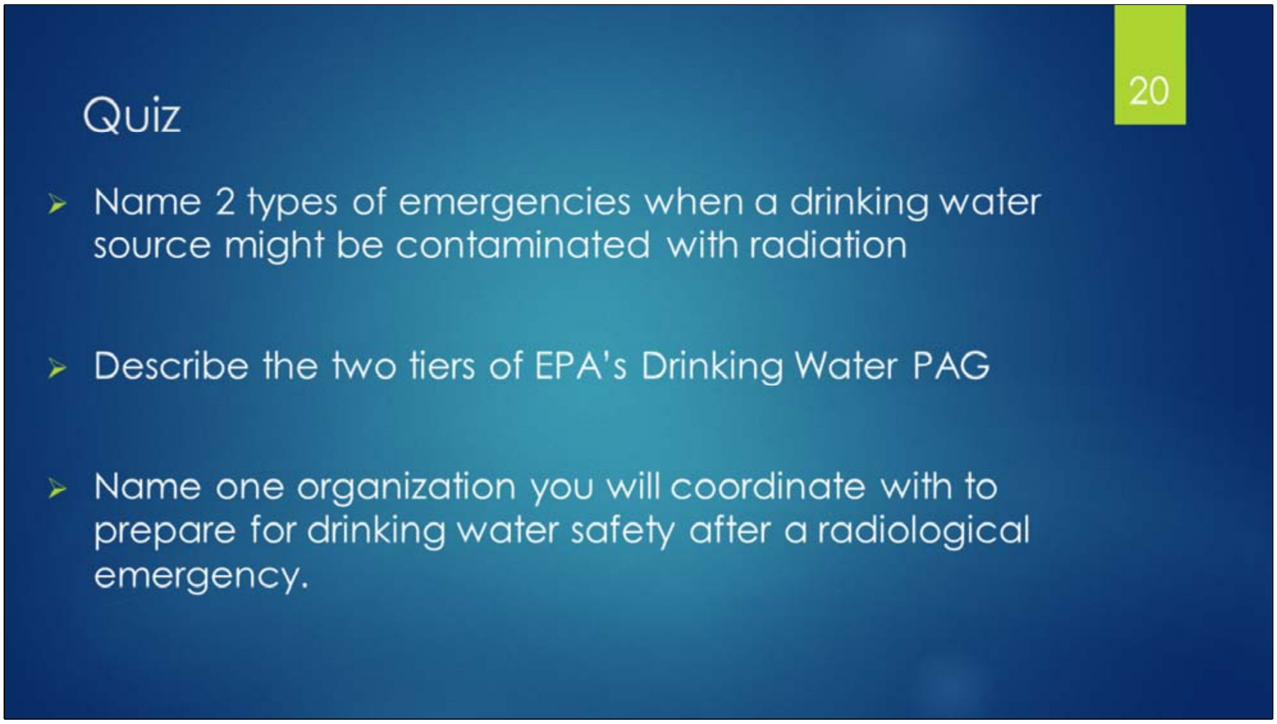
Here is a question for everyone, in the chat box – name two people or organizations that you should contact to start planning on how your organization or facility will protect public drinking water during a radiological emergency. Let me repeat the question – name two people or organizations that you should contact to start planning on how your organization or facility will protect public drinking water during a radiological emergency.

While you are doing that – Here are some planning considerations for you to think about with those other people or organizations:

- How are you going to monitor the water during an emergency
- Are you planning to use the PAGs or another level as that in which to provide alternative drinking water?

<<Speaker to talk about the question and answer>>

There are preventative actions that may be taken in advance of an anticipated release including temporarily closing of water system intake valves to prevent entry of contaminant plume. But emergency response plans should consider whether sufficient storage capacity is available to support the community's fire suppression and sanitation needs while intake valves are closed



Now we are at the end of the course and I want to know if you remembered the key takeaways that I mentioned at the beginning of the course by participating in our final quiz.

Our final quiz will be an interactive quiz -- that I'll show in just a minute – but first let me read our quiz questions aloud:

•Name 2 types of emergencies when a drinking water source might be contaminated with radiation **<u>(Radioactive plume that falls into the river where it ends up in the water distribution system; nuclear weapon detonation event)</u>**

•Describe the two-tiers of EPA's Drinking Water PAG

•Name one organization you will coordinate with to prepare for drinking water safety after a radiological emergency.

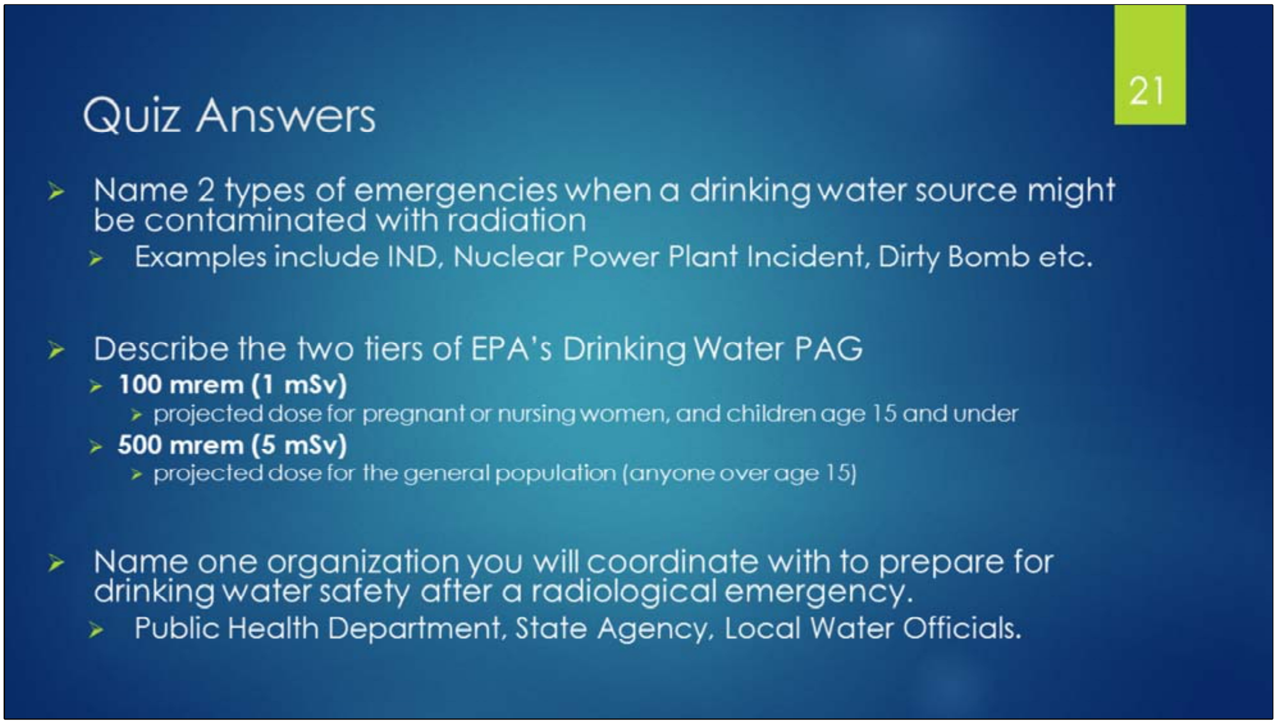
I'll now change our screen layout so that you can respond to the three quiz questions **<<speaker to push to final quiz layout AND then read the following text>>**

You will now see our three quiz questions at the top center of your screen, and then three polling pods at the bottom of your screen. In the first box, please respond by typing a short response to the question “name 2 types of emergencies when a drinking water source might be contaminated with radiation”. <<Speaker to pause and let responses come in>>

In the second box on your screen, please type a short response to answer the question “describe the two tiers of EPA’s Drinking Water PAG”. Remember we are looking for numerical values here. And this is open book – so please use any available resources you might have handy to answer the question.

By now I imagine you know the drill - In the third box on your screen, please type a short response to answer the question “name one organization you will coordinate with to prepare for drinking water safety after a radiological emergency.

I’m going to give folks a few more seconds to respond to each of the quiz questions, and then I’ll summarize the responses we’ve received today, along with the correct answers.



How does everyone feel about the quiz and their answers? Let's talk through some of the correct answers.

Question 1 - Name 2 types of emergencies when a drinking water source might be contaminated with radiation – correct answers for this question would include an IND, nuclear power plant incident, dirty bomb, or a situation where a radioactive plume that falls into the river where it ends up in the water distribution system).

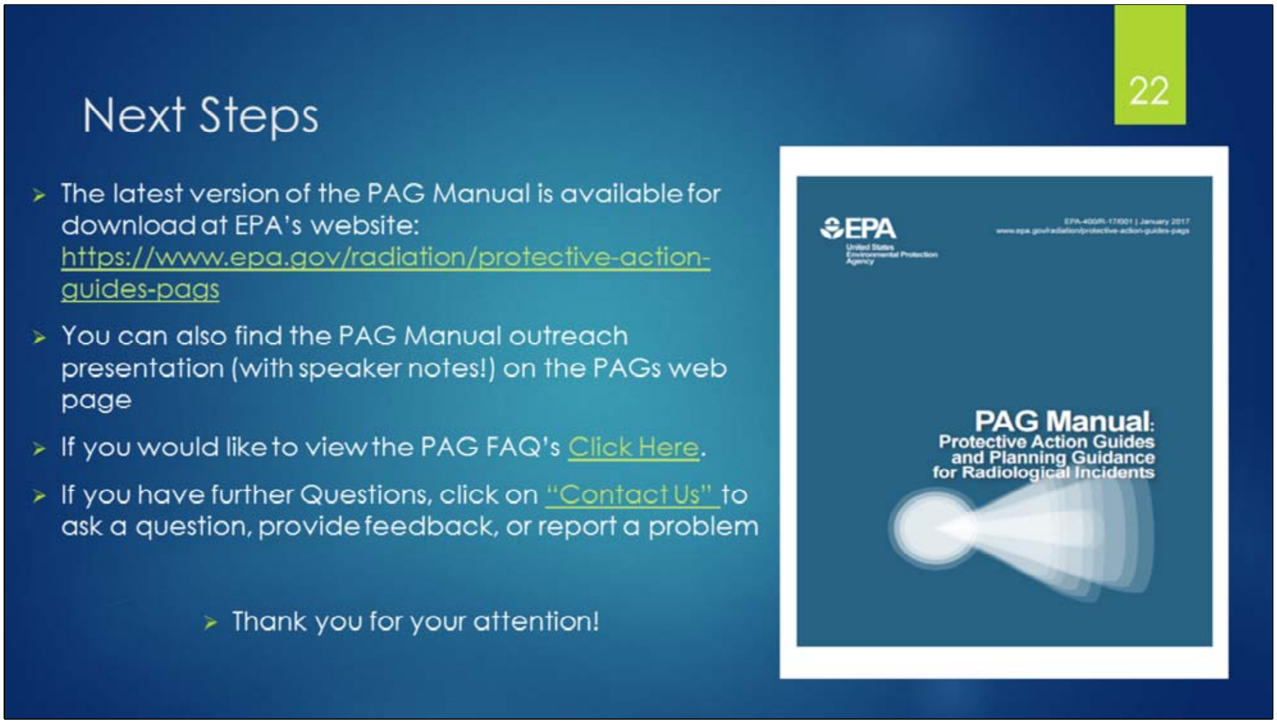
Question 2 - Describe the two-tiers of EPA's Drinking Water PAG – If you remember there are two tiers of EPA's drinking water PAG – the first tier – 100 mrem set to be protective for pregnant or nursing women, and children 15 and under. The second tier – 500 mrem set to be protective for the general population, including anyone over 15.

Question 3 - Name one organization you will coordinate with to prepare for drinking water safety after a radiological emergency – there are lots of correct answers for this question, and I saw a lot of different responses come in to the presenter view of Adobe Connect. Some of the many correct answers to this question include the public health department (local or state), other state agencies, and local water officials.

I'd now like to pause and see if anyone on today's webinar has any questions about the quiz or the quiz answers. If you do, please type a chat into the chat box, or unmute yourself to speak on the line.

<<Pause for questions>>

It looks like there are no questions about our quiz, so let me move on to our last slide.



We are going to make these slides and speaker notes available to you all, and will work your questions into FAQs.

Go check out the new FAQs we've posted on the link here (you can click the link right now right in Adobe Connect), and feel free to type your comments or questions into the Chat box.

We plan to host another series of webinars to discuss the drinking water PAG in more detail, soon.

<<If time allows>> We have a few minutes for questions today, so I'd like to take the opportunity to ask for anyone with questions to unmute yourself and speak up over the phone line, or type your question in the chat box.

Thank you for participating in our webinar today.