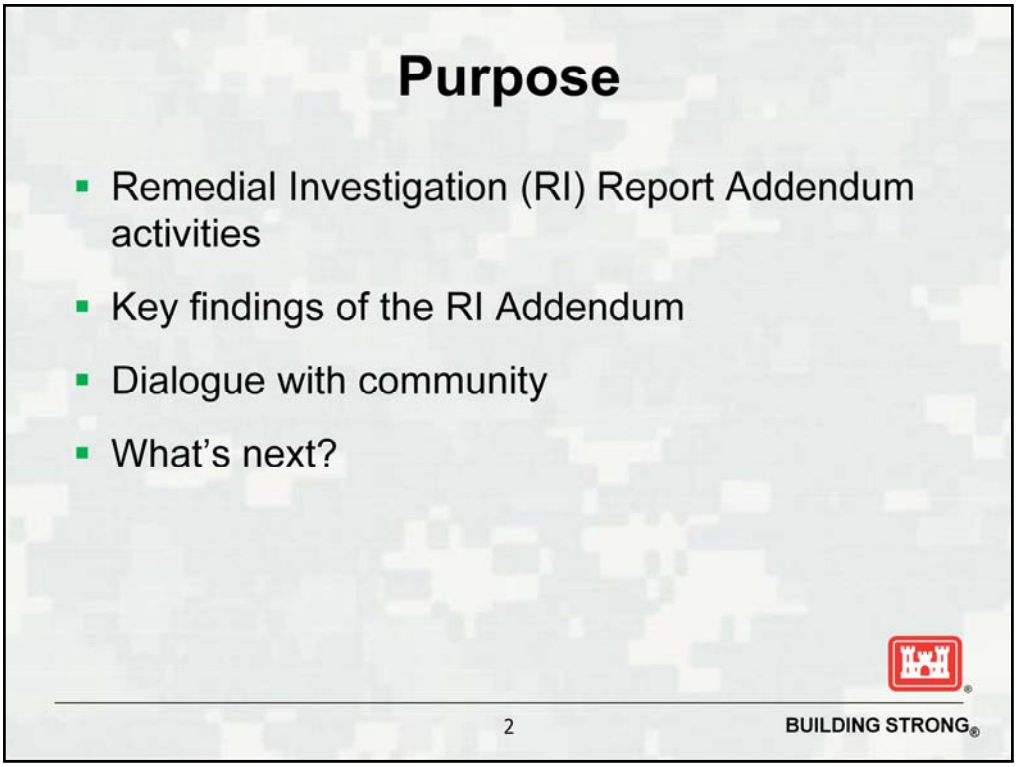
SLIDE 1 – John Busse, USACE

Welcome to the Niagara Falls Storage Site (NFSS) Remedial Investigation (RI) Report Addendum Workshop. Throughout this presentation we are going to refer to the Remedial Investigation as the RI, and the latest report as the RI Addendum.

I'd now like to take a moment to introduce the Corps' NFSS Project Team

- John Busse – LOOW/NFSS Program Manager
- Jane Staten – NFSS Project Engineer
- Michelle Barker – Regional Technical Specialist
- Dr. Karen Keil – Risk Assessor
- Jeff Hall – Environmental Engineering Team Leader
- Arleen Kreusch – Outreach Specialist
- Natalie Watson – Outreach Specialist
- Bruce Sanders – Public Affairs Officer
- Andrew Kornacki – Public Affairs Officer
- Roger Burch – Strategic Planner
- Douglas Sarno – Forum Facilitation Group, IWCS FS Technical Facilitator
- SAIC (Hallie Serazin, Risk Assessor; David Kulikowski (AVESI); Steve Conner, Project Manager;)
- HydroGeoLogic (Eric Evans, Hydrogeologist)



SLIDE 2 - Hallie Serazin, SAIC

The purpose of today's workshop is to present a brief overview of activities conducted for the RI Addendum along with the key findings from those activities. The RI Addendum covers work conducted at the site to:

•Provide more information on the type and distribution of contamination in groundwater,

•Provide more information on the potential for off-site migration,

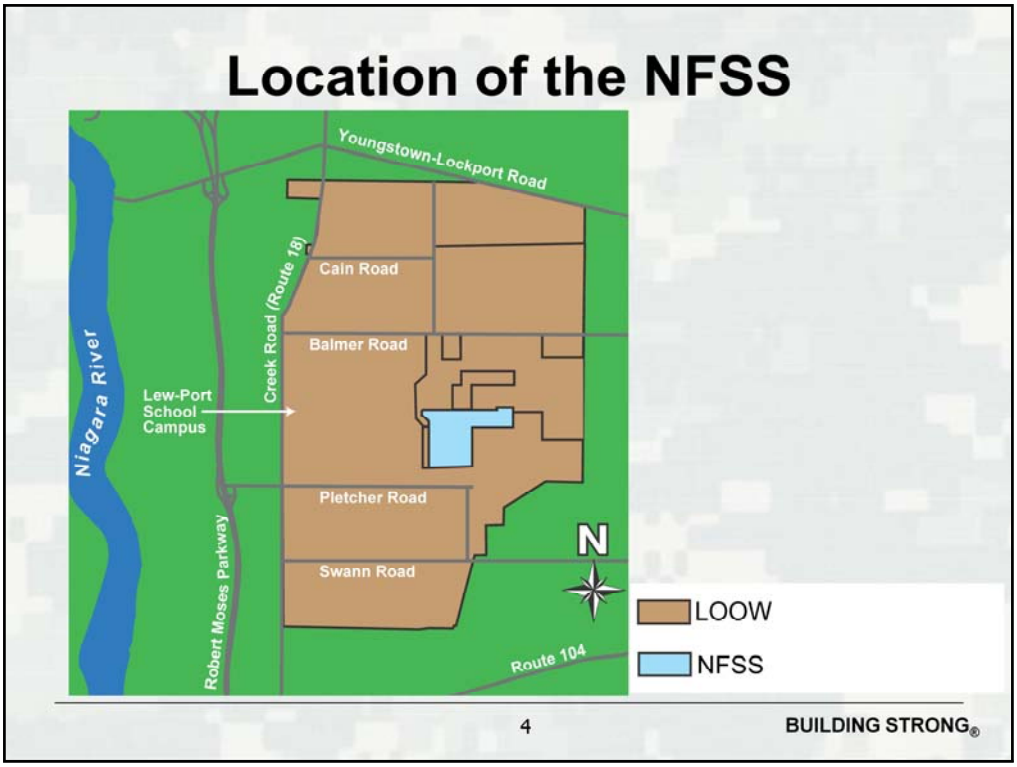
•Confirm that the Interim Waste Containment Structure (IWCS) is performing as designed, and

•Further investigate the possibility for plutonium and fission products at the NFSS.

Finally, we will present a brief summary of on-going and future activities related to the NFSS Feasibility Study.

•**SLIDE 3** – Hallie Serazin, SAIC

We will begin by reviewing where the NFSS is in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. We will then move on to present RI Addendum results for three groundwater areas of interest. These areas are the Baker-Smith Area, the Acidification Area, and the IWCS Area. Questions will be taken from the audience following the presentation of each topic. At the conclusion of the presentation, we invite you to come up and take a look at the posters, which show information from the RI and the RI Addendum. While you are reviewing the posters, the NFSS project team will be available to respond directly to your questions. You may also submit questions by sending us an e-mail or by filling out a comment card.

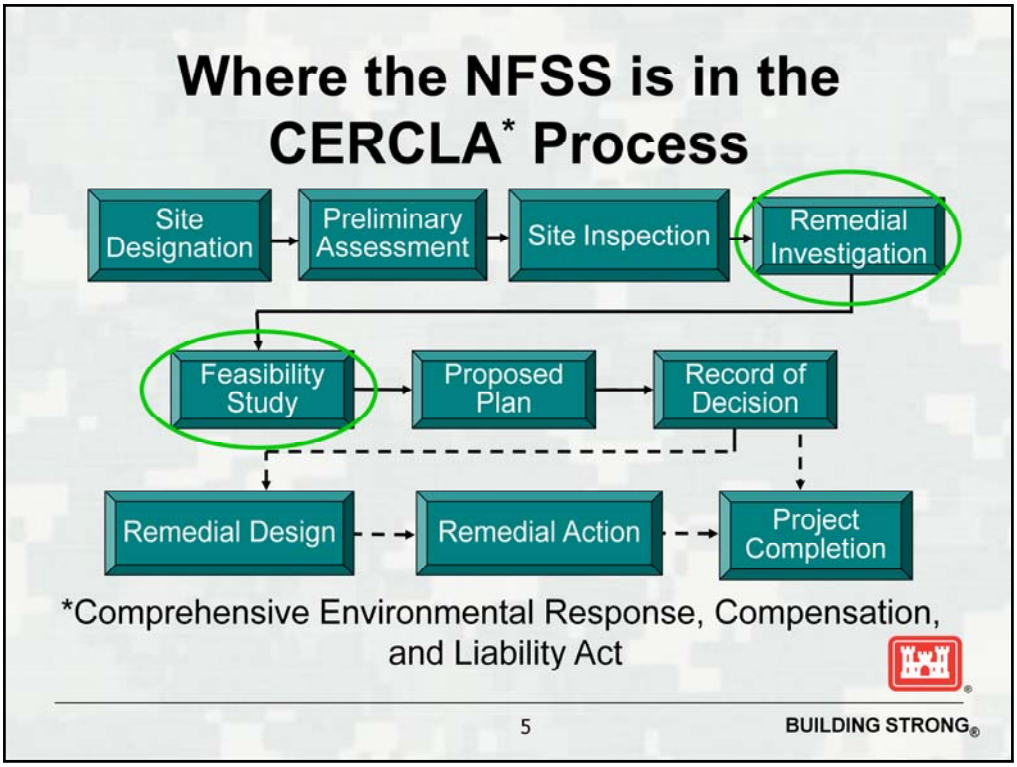


SLIDE 4 – Speaker: Hallie Serazin, SAIC

In 1942, the U.S. Government acquired approximately 7,500 acres of land in northwestern New York State and constructed a TNT production plant known as the Lake Ontario Ordnance Works (the LOOW), which is shown here in tan. Production of TNT at the LOOW was short-lived and ended a year later in 1943.

In 1944, the Manhattan Engineer District (MED) was granted use of a portion of the LOOW for storage of radioactive residues. The residues are the materials left over after processing uranium ore to remove the uranium which was used in development of the atomic bomb. The radioactivity comes from natural decay of uranium in the ore; the radioactivity was concentrated by processing.

The decision to store the radioactive residues on a portion of LOOW created the NFSS and between 1944 and 1954, the MED and its successor agencies periodically shipped radioactive residues and materials to the NFSS for storage. The NFSS is shown on this slide in blue. Just to orient you, we are meeting tonight at the Lewiston Senior Center which is located on River Road. *(The speaker will point out the location of the Senior Center.)*

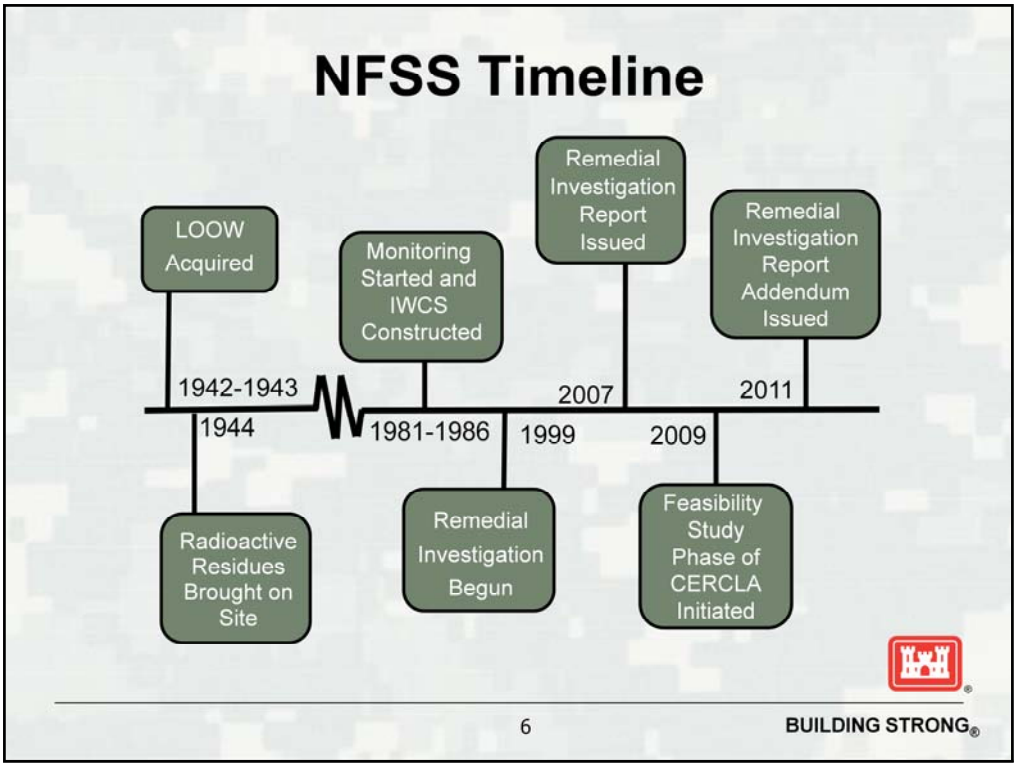


SLIDE 5 – Hallie Serazin, SAIC

The Corps is required by law to comply with CERCLA in conducting the Formerly Utilized Sites Remedial Action Program (FUSRAP) cleanup work. The CERCLA program lays out a systematic process for identifying, investigating, and cleaning up hazardous waste sites. This graphic shows where we are in that process.

The purpose of an RI is to define the nature (types and concentration of chemicals) and extent (length, width, and depth) of site contamination, and to evaluate potential risks to human health and the environment.

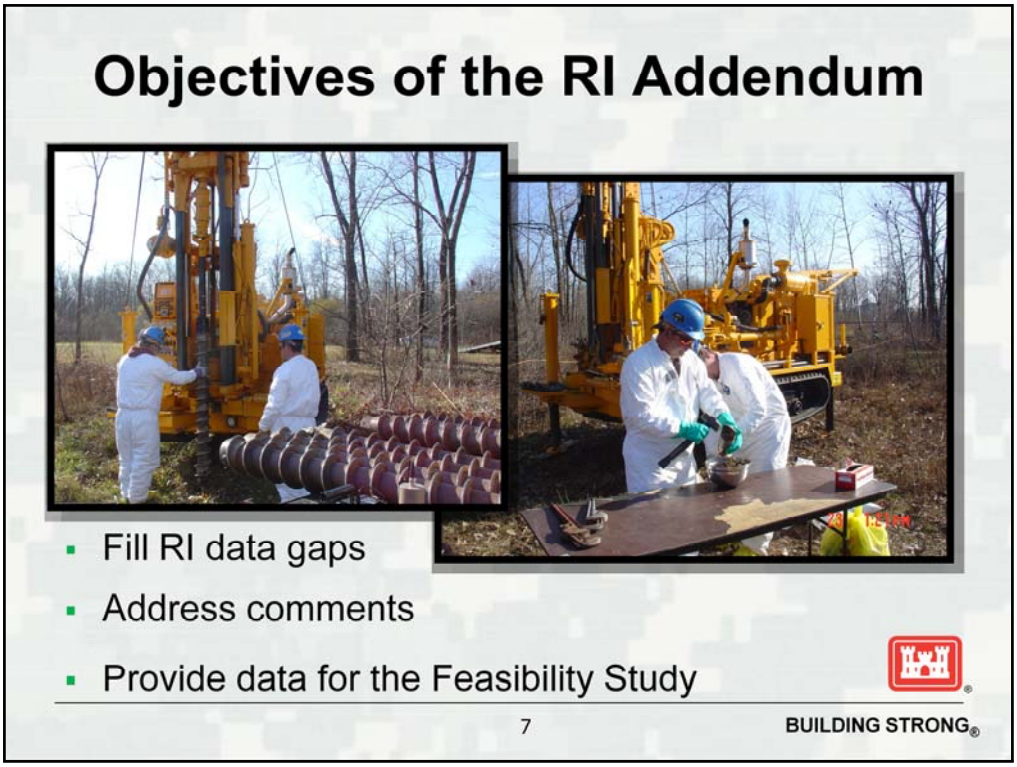
The next step in the CERCLA process is the Feasibility Study. During the Feasibility Study, multiple remedial alternatives to address site contamination will be evaluated. Each remedial alternative will be an integrated set of actions that could be used to clean up the site. Multiple alternatives are considered so that the best one can be selected. Initial efforts have begun for the Feasibility Study. Several technical memoranda are currently being produced as part of the Feasibility Study process for the IWCS Operable Unit.



SLIDE 6 – Hallie Serazin, SAIC

An RI Report for the NFSS was issued in 2007. Additional RI efforts were conducted to address areas where more data was needed (data gaps) and to address stakeholder comments. Findings of these efforts are presented in the RI Addendum and are the main topic of this workshop.

The NFSS RI included sampling results for soil, surface water, sediment, and groundwater. This report also included a baseline risk assessment and a groundwater contaminant fate and transport model. The RI was used to decide where more information was needed to understand current conditions at the NFSS, as well as to prepare for evaluating remedial alternatives. The additional information needed was obtained by investigations conducted for the RI Addendum during 2009 and 2010. Results were compiled and evaluated in the RI Addendum document, which was released in April 2011.



SLIDE 7 - Hallie Serazin, SAIC

Comments on the 2007 RI submitted by local, state, and federal regulatory agencies, as well as the community, covered a wide range of topics and formed the basis for the RI Addendum investigations. These photos show well installation and soil sampling activities conducted during the RI Addendum field work. Tonight's presentation will focus on the key topics covered by the RI Addendum.

Responses to stakeholder comments on the RI have been posted on the project website: (*http://www.lrb.usace.army.mil/fusrap/nfss/nfss-ri-publiccommentresponse-2010-08.pdf*).

The combination of data from the 2007 RI Report and the RI Addendum, as well as earlier information on the NFSS, provides the information needed to initiate the IWCS Operable Unit Feasibility Study.

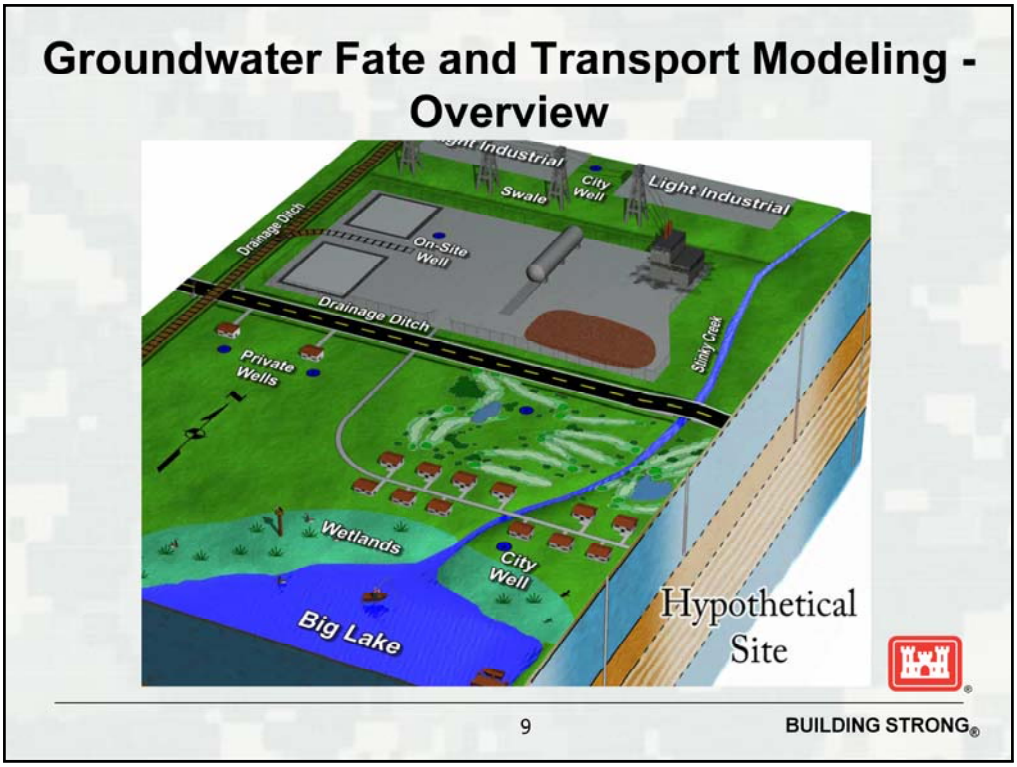
SLIDE 8 - Hallie Serazin, SAIC

Tonight we will be discussing key RI Addendum topics which were selected based on public comments, as well as topics that have the greatest potential impact to human health and the environment. These topics are listed on the slide.

The Corps would like you to be aware of the additional RI Addendum topics that will not be covered in detail during tonight's presentation, but that are covered in the RI Addendum document. These topics include:

- Additional evaluation of NFSS background data sets
- Screening of recent Environmental Surveillance Program data
- Review of radiological results from samples collected during the LOOW Underground Utilities Remedial Investigation
- Review of railroad ballast, building core, and road core samples
- Presentation of supplemental documentation that was requested by RI reviewers

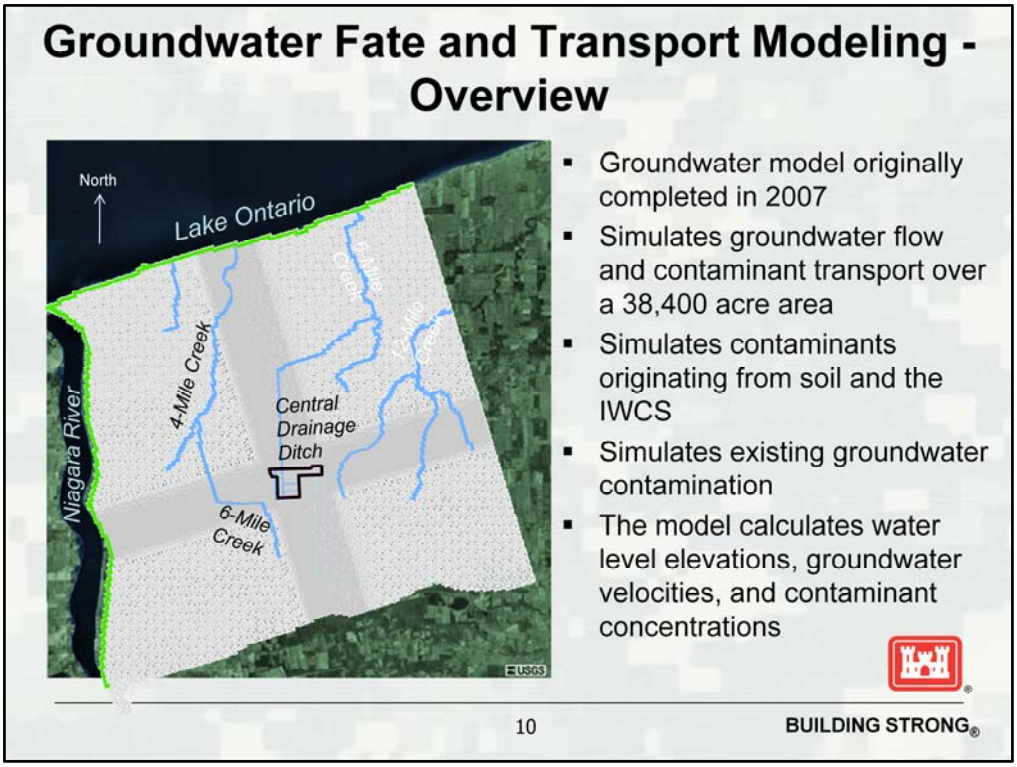
Let's begin by taking a look at the nature and extent of groundwater contamination. First, Eric Evans, representing HydroGeoLogic (HGL), will present a hypothetical model of groundwater modeling that shows the predicted behavior of contaminants in groundwater over time. Eric will also be presenting groundwater modeling results completed for each groundwater area of interest as we proceed through the presentation topics.



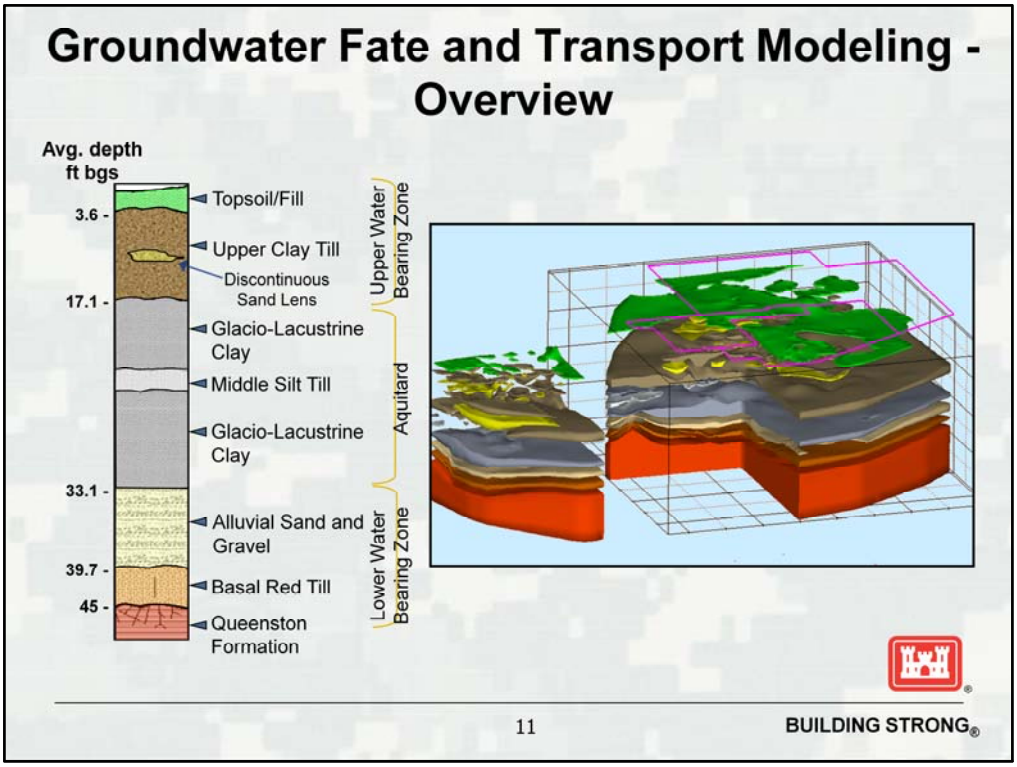
- There are several different ways in which contamination can be introduced to groundwater. If rain water travels through contaminated soil or waste materials, it may dissolve some of the waste and contaminate groundwater, surface water, and/or sediment. This commonly occurs when contaminants are concentrated in surface soils or soils that are buried close to the surface. During rain events, the precipitation either accumulates on the ground surface, runs off into surface water streams, evaporates, or infiltrates into the ground. The portion that infiltrates into the ground can eventually intersect groundwater beneath the water table. The water table is the location within the ground where the void spaces in the soil or rock are full of water. If the infiltrating water is contaminated, then it can contaminate cleaner water beneath the water table. In general, groundwater predominantly moves vertically as it travels through the unsaturated soils. Beneath the water table, groundwater flow is predominantly horizontal; although there is commonly a vertical component of the groundwater flow.

- I'm going to illustrate this concept through the use of an animation. I want to stress that the animation shows a hypothetical site that is much different than the NFSS. The geologic units beneath the NFSS primarily consist of clay, which do not easily transmit water. The water-bearing unit for the hypothetical site is primarily sands, which readily transmit water. In addition, the hypothetical site is a fictional wood treating facility.

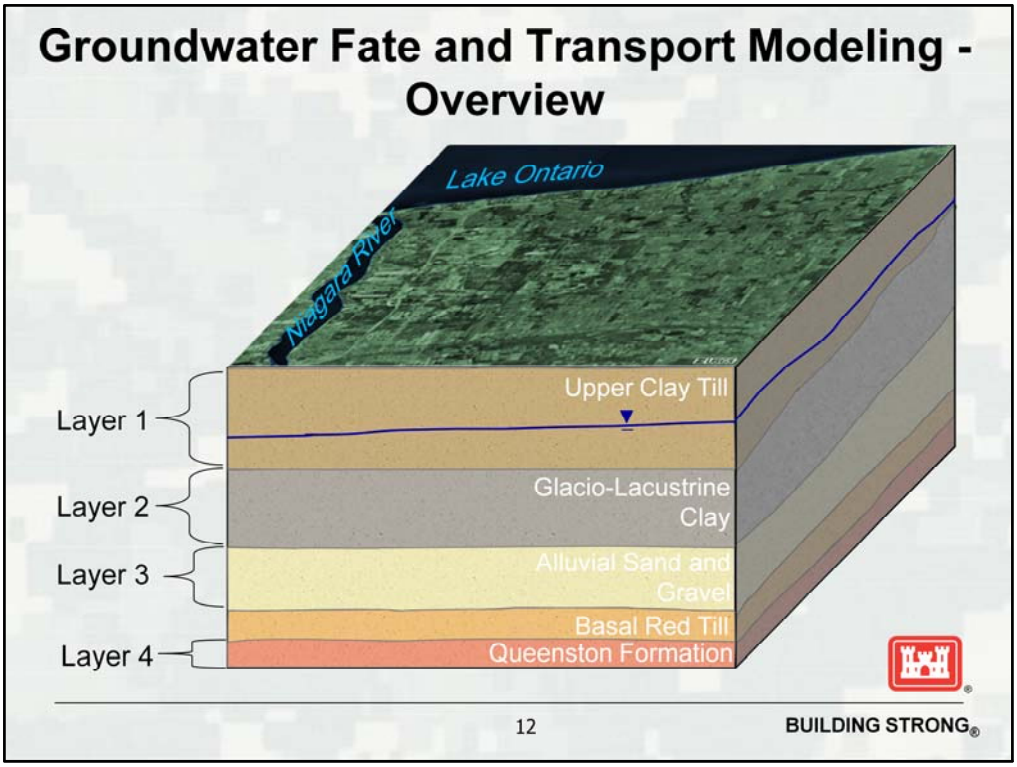
- At the beginning of the animation, precipitation hits the land surface, and a significant portion of the water runs off to nearby ditches and a nearby stream. As the animation rotates, you can see a cross section of the subsurface. As precipitation flows through three contaminated areas, it transports contaminants vertically through the unsaturated soils. Once it hits the water table, it contaminants clean groundwater and is transported horizontally. In this hypothetical example, the groundwater is eventually captured by a stream.



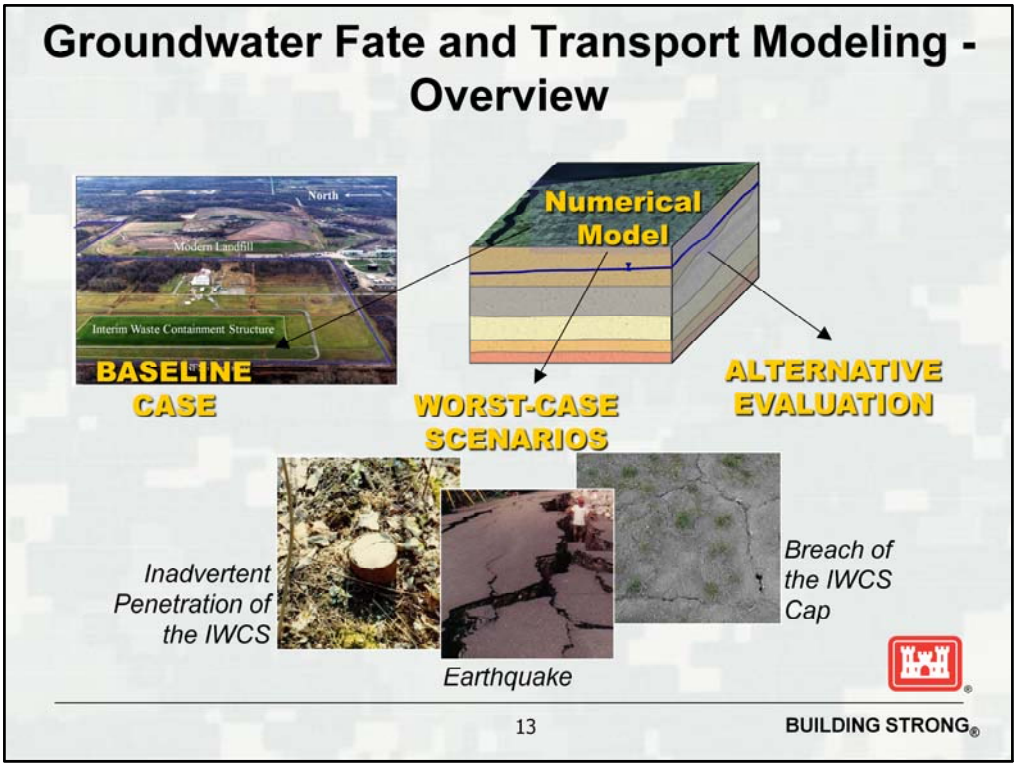
We commonly use groundwater models to simulate the processes that were discussed on the previous slide. Models allow us to make predictions into the future and evaluate contaminant transport under unforeseen events such as earthquakes or floods. A groundwater model was developed to simulate groundwater flow and the transport of contaminants originating from the NFSS. The model covers a 38,400 acre area surrounding the NFSS extending from the foot of the Niagara Escarpment northward to Lake Ontario, and eastward to the Niagara River. The purpose of the model was to predict future contaminant concentrations in groundwater underlying the NFSS and surrounding area. The model was completed in 2007 and it was recently revised using new data collected as part of the RI Addendum data collection activities. The model was constructed using the MOD-HMS modeling software, which calculates water-level elevations, groundwater velocities, and contaminant concentrations within a grid of model cells. The size of these model cells is smaller within the NFSS, where we need a high degree of accuracy; and the model cells are larger outside the NFSS where we require less resolution. The model incorporates a lot of important hydrologic features such as the precipitation recharge, surface water bodies, geometry and thickness of the water-bearing units, and the hydraulic properties of these units. It was developed based on a large volume of data collected at the NFSS, data obtained from adjacent properties Chemical Waste Management (CWM), and Modern Landfill, as well as available regional data (e.g., from private wells, USGS and other sources).



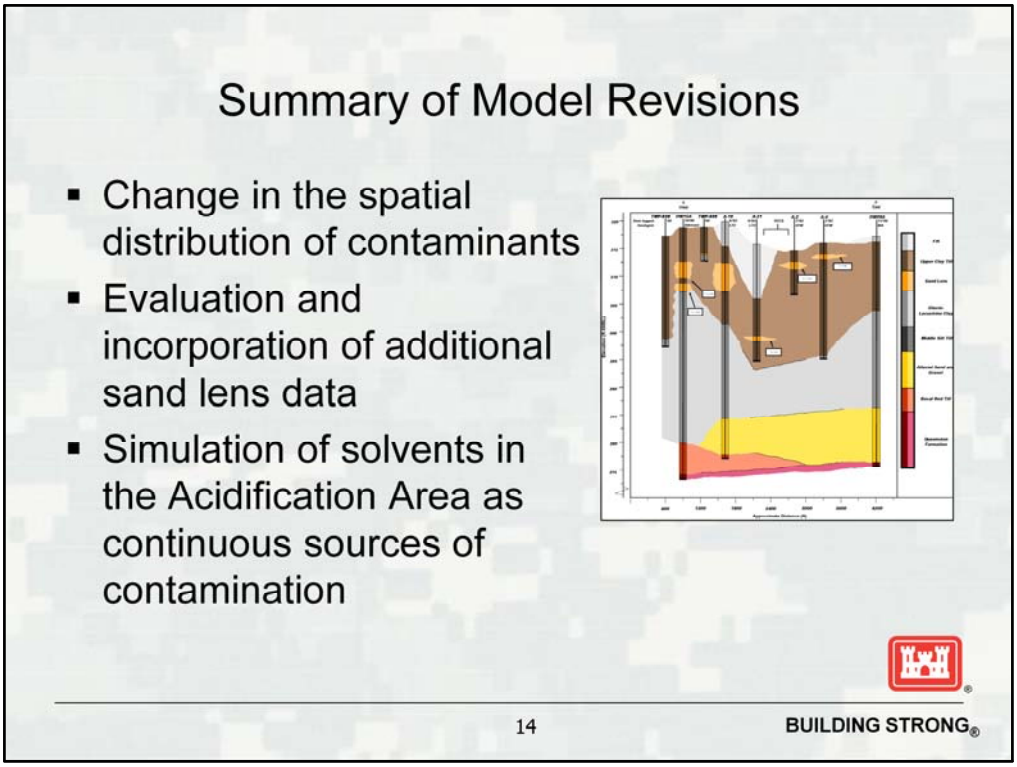
- The model simulates groundwater flow in three dimensions. Consequently, it was important to have a strong understanding of the geologic units that control the flow of groundwater, and this was attained by evaluating a large volume of recent and historical data. This slide shows the primary geologic units underlying the NFSS and surrounding area. In terms of contaminant transport, the two most important water-bearing units are those closest to the surface, which are the Upper Clay Till and the Glacio-Lacustrine Clay. Both of these units consist primarily of clay. Discontinuous sand lenses are present within the Upper Clay Till; however, these sand lenses are not well connected. Groundwater moves through the void or open spaces between the subsurface soil. Water moves slowly through clay, because the size of the voids spaces within clay particles is very small, and the movement of water is restricted. The Glacio-Lucustrian Clay is considered an aquitard, which is a geologic unit that impedes the vertical movement of water.



- The model was constructed using four layers of model cells. These layers represent the primary geologic units underlying the NFSS and surrounding region. The top and bottom elevation of each geologic unit was determined using geologic data collected through subsurface drilling.



- After the NFSS model was constructed and verified using actual field data. The model was then applied to predict the future migration of contaminants originating from the site. Computer simulations were conducted to predict the long-term migration of contaminants assuming current site conditions (i.e. baseline simulations). Simulations were conducted to evaluate the impact of four worst-case scenarios; inadvertent penetration into the interim waste containment structure (IWCS); a large-scale breach of the cap; and the impact of a large scale earthquake. The model will also be used to help evaluate the effectiveness of remedial alternatives that will be evaluated in the feasibility study.

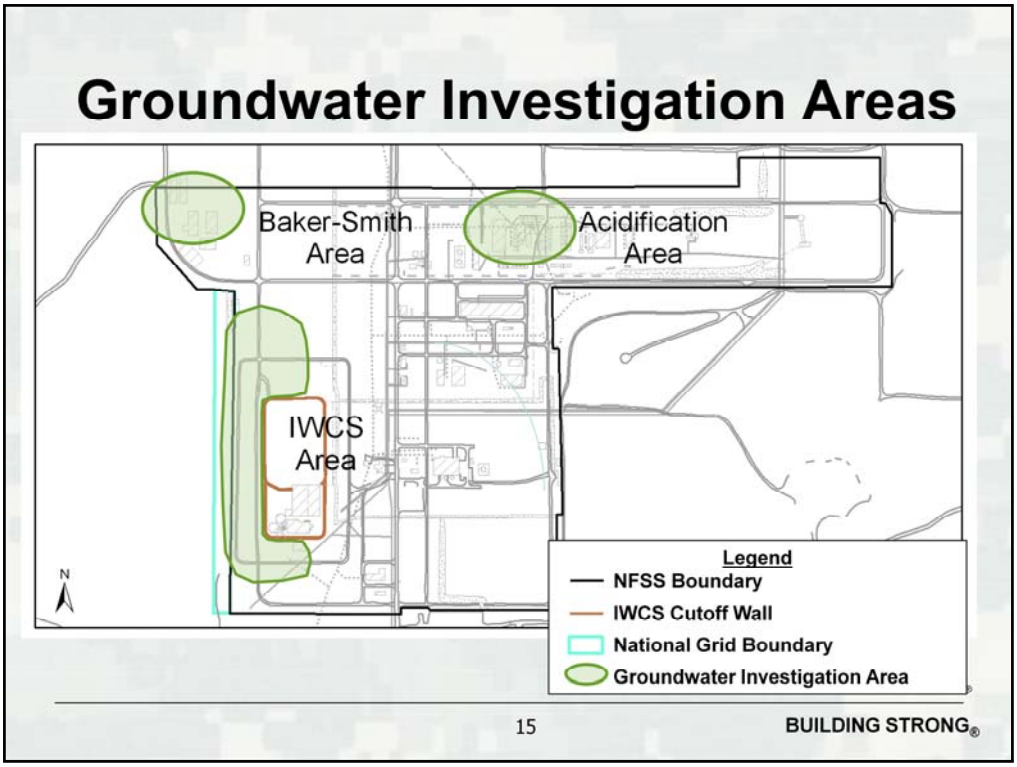


- The groundwater model was recently revised to incorporate new data that was collected during the RI Addendum work activities. The most significant revision involved revising the initial distribution of groundwater contaminants that are represented in the model. As previously discussed, additional groundwater data were collected in the Acidification, IWCS, and Baker-Smith Areas. These field efforts resulted in a better understanding of the extent of contamination in these areas. This improved understanding was translated onto maps showing the distribution of contaminants, and this information was incorporated into the model. This will be discussed later in the presentation.

- As part of the original RI effort, a geostatistical analysis was conducted to determine the spatial continuity of the sand lenses within the Upper Clay Till. The purpose of this study was to determine whether these sand lenses could be interconnected over significant distances, which could provide a preferential pathway for groundwater flow and contamination. The geostatistical analysis concluded that the sand lenses were, in general, limited to 15 to 20 feet in lateral extent. This conclusion was supported by the development of cross-sections showing the subsurface geology.

- The drilling activities that were conducted as part of the RIR addendum activities resulted in new information related to the subsurface geology and the occurrence of sand lenses within the Upper Clay Till. This data was used to revise the cross-sections and to develop new cross-sections. Geologic profiles collected during trenching of the clay dikes were also used in this analysis. The reevaluation of the sand lens data reaffirmed the original conclusions. The sand lenses appear to be discrete features that are not interconnected over significant distances. Nonetheless, to more accurately represent the sand lenses in the model, the model was updated to explicitly represent each observed sand lense as a 25 foot feature spanning the entire Upper Clay Till. This did not significantly change the contaminant transport predictions simulated using the model.

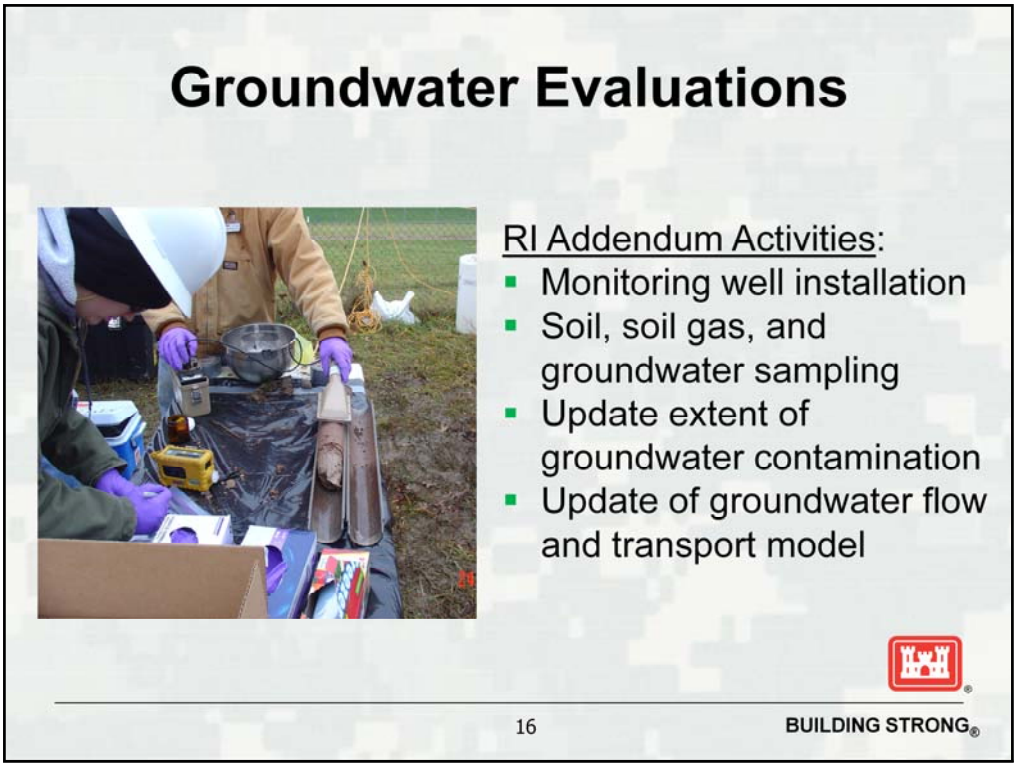
- Finally, the model was revised to more conservatively represent the source of solvent contamination within the Acidification Area. To provide a more conservative estimate of contaminant migration in this area, the solvents were represented as a constant concentration in the model. As the model simulates conditions over a 10,000 year period, the solvent concentrations in the source area are predicted to stay the same. This conservatively assumes that the contaminant mass in the source area is not depleted as it slowly dissolves into groundwater that flows through it. An animation showing the model results will be discussed later in the presentation.



SLIDE 15 – Speaker: Dave Kulikowski, Avesi

A data gap identified in the RI Report was the extent of groundwater contamination along the northern and western boundaries of the site. This slide shows the general areas of interest where additional field investigation was conducted in 2009-2010, which includes the Baker-Smith Area, the Acidification Area, and the IWCS Area.

Although groundwater is not used for drinking water at this site, the groundwater samples are compared to drinking water standards as a way to identify areas where contamination is a concern.



SLIDE 16 – Speaker: Dave Kulikowski, Avesi

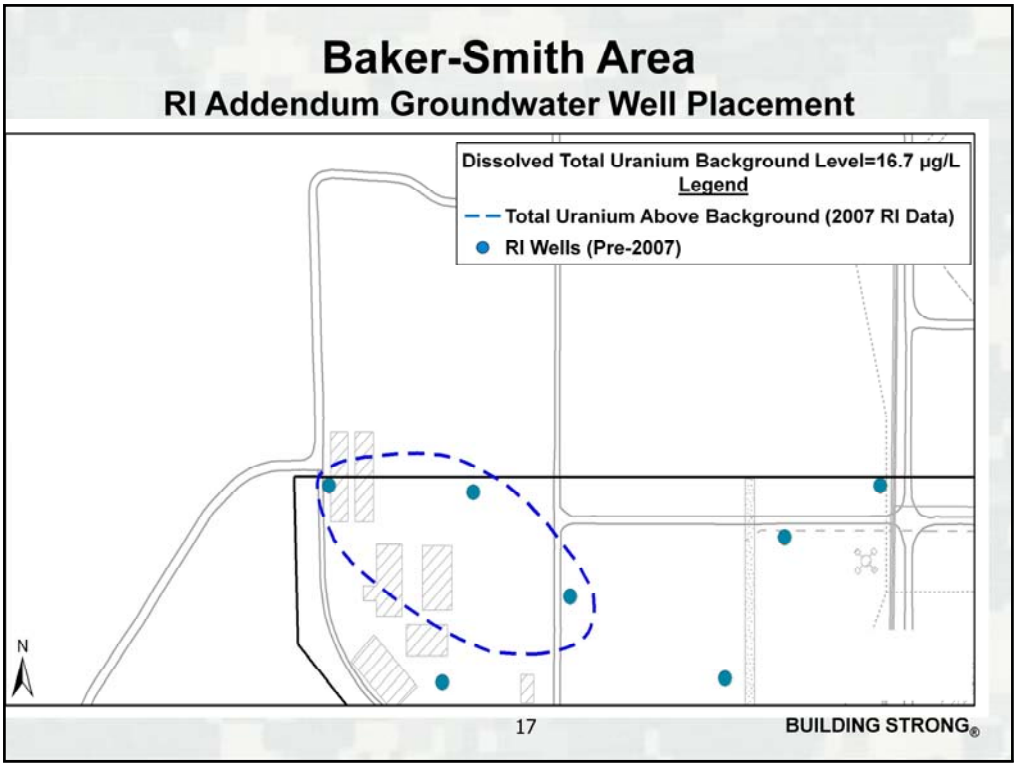
To enhance our understanding of groundwater contamination in the three areas of interest, the Corps completed the following tasks:

• *Temporary and permanent monitoring well installation.* 23 temporary wells were installed in the three groundwater areas of interest. Groundwater sampling results collected from these temporary well points and other site characteristics were used to determine which well locations should be converted to permanent monitoring wells. The resulting 10 permanent monitoring wells are being used to monitor groundwater quality and ensure protectiveness of human health and the environment.

• *Soil, soil gas, and groundwater sampling*. Soil and groundwater sampling was conducted in all three investigative areas to further refine the extent of groundwater contamination. As shown in the picture on this slide, soil borings were scanned for radioactivity prior to sampling. Additionally, soil gas samples were collected to address potential on-site (localized) exposure to organic solvents in soil and groundwater in the Acidification Area.

• *Update extent of groundwater contamination*. The extent of groundwater contamination was updated based on newly acquired groundwater sample results.

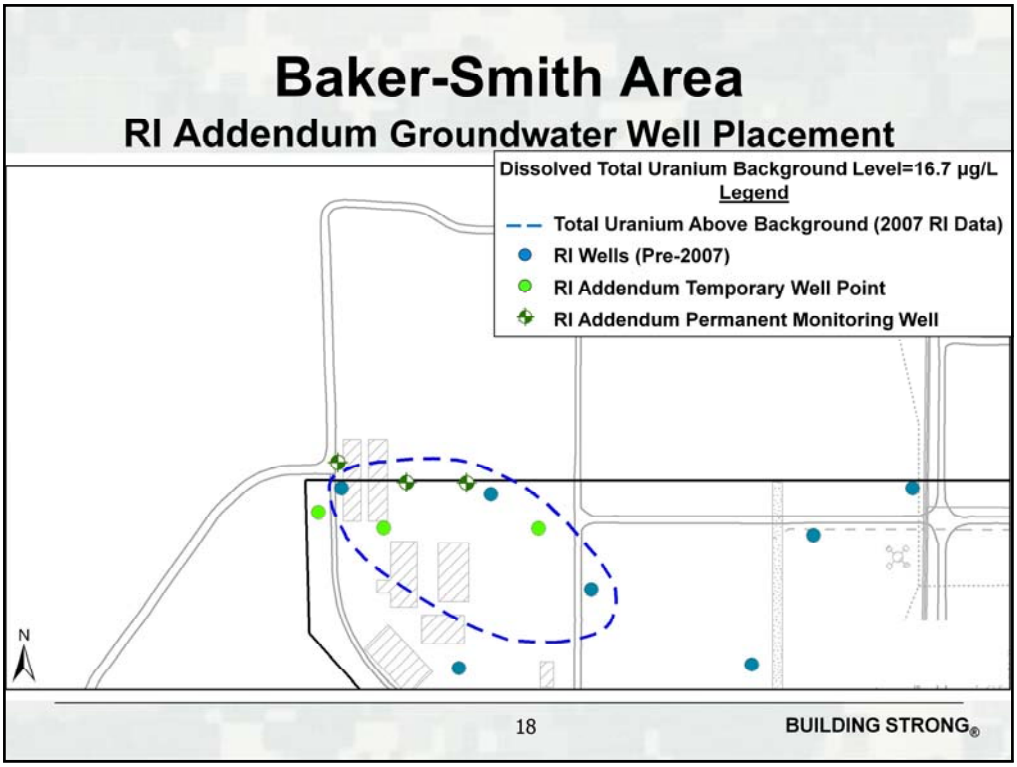
• *Update of groundwater flow and transport model*. As explained earlier, the groundwater flow and transport model was updated to further evaluate the extent of groundwater contaminants.



SLIDE 17 – Speaker: Dave Kulikowski, Avesi

The Baker-Smith Area is located in the northwest corner of the NFSS. During LOOW operations, a pipe shop, machine shop, welding shop, and a store house were located in the Baker-Smith Area. The area was later used as a residue storage area for L-30, K-65, and Knolls Atomic Power Laboratory waste. Currently, the area is bordered by the NFSS perimeter fence to the north and west. During the RI, an area of dissolved total uranium in groundwater was identified in this area. Additional investigation of this localized groundwater contamination was conducted for the RI Addendum to determine if uranium concentrations above groundwater background levels extend off-site.

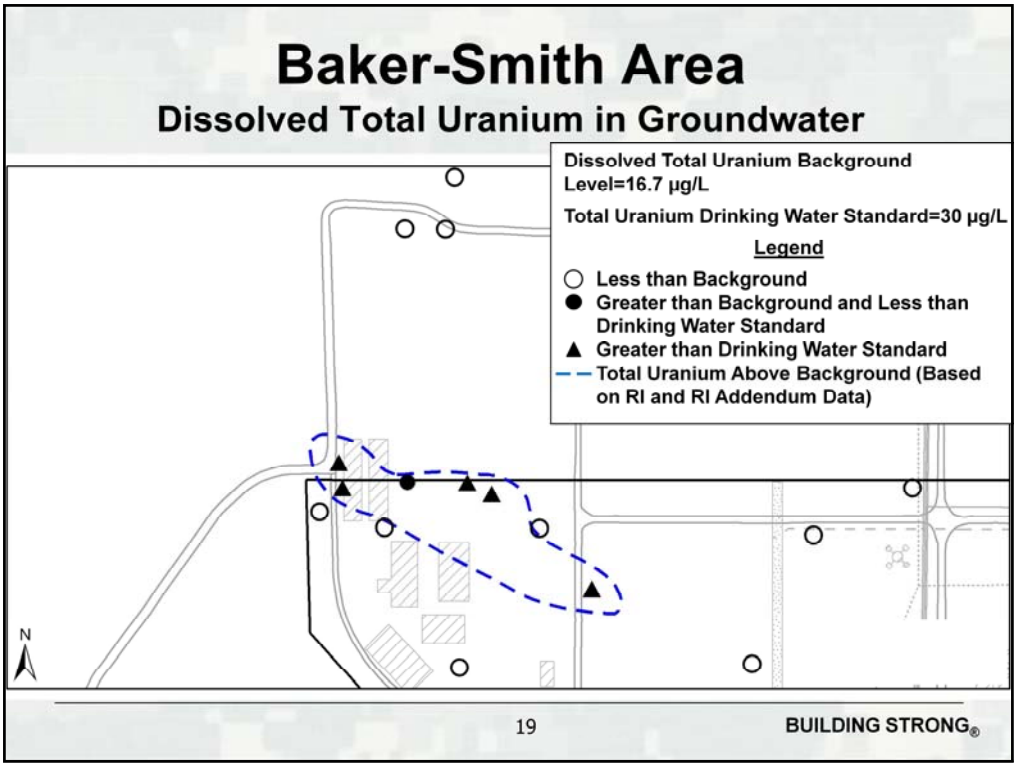
This figure shows the groundwater contamination identified during the 2007 RI. The blue dots identify the existing RI wells. These wells were used to define the extent of uranium contamination in groundwater, as shown above.



SLIDE 18 – Speaker: Dave Kulikowski, Avesi

Six new sampling locations in the Baker-Smith Area were installed as temporary well points to further refine the extent of contamination in groundwater. Three well locations, shown as dark green quartered circles, were converted to permanent monitoring wells that can be used to monitor this area of groundwater contamination along the northern property boundary. The three remaining new well locations, shown as bright green dots, were temporary well points.

This slide also illustrates the area of dissolved total uranium groundwater contamination identified in the Baker-Smith Area based on Phases 1 through 3 of the RI. The area of groundwater contamination includes concentrations of dissolved total uranium above the background value of 16.7 micrograms per liter (µg/l).



SLIDE 19 – Speaker: Dave Kulikowski, Avesi

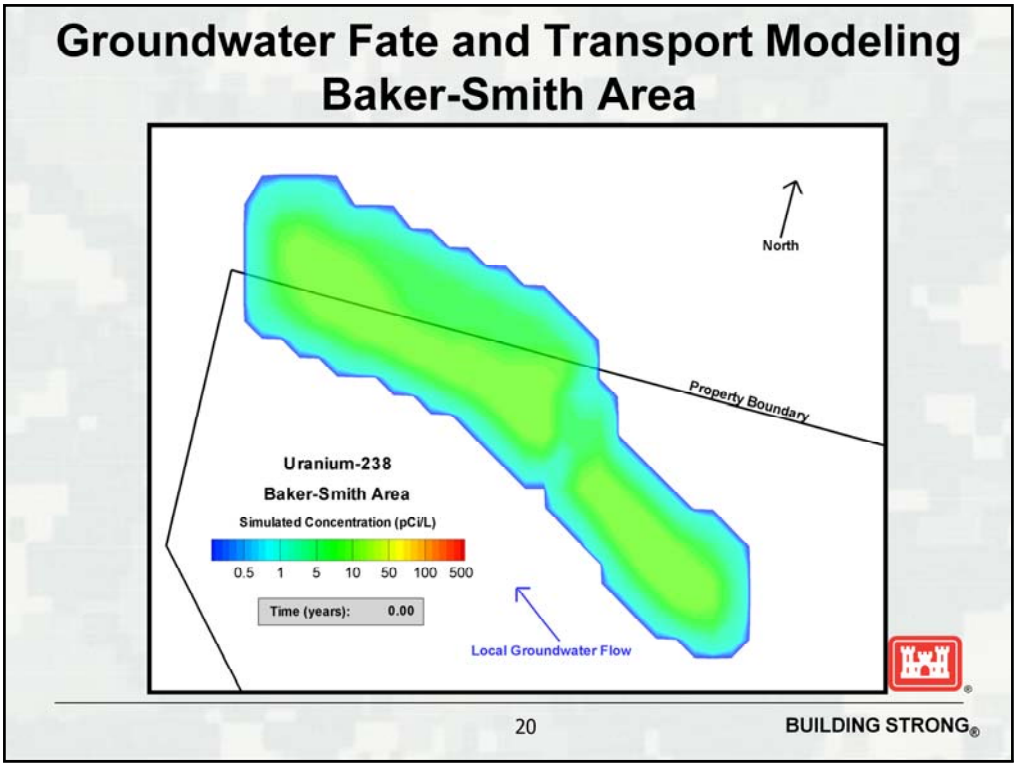
By comparing the area of groundwater contamination shown on the previous slide with the updated area of groundwater contamination shown on this slide, you can see that the area of dissolved total uranium in groundwater at the Baker-Smith Area is actually more narrow than once thought and does not extend as far to the south.

On this figure and all groundwater quality maps in this presentation, the hollow and filled circles represent groundwater that meets the drinking water standard (the hollow circles are below the background level, and the filled circles are above background but below the drinking water standard). The filled triangles show groundwater samples that were above the drinking water standard.

The Corps determined that dissolved total uranium is present in groundwater in one well to the northwest of the property boundary at a concentration of 37.5 µg/l, which is above the background level and slightly above the uranium safe drinking water standard, or maximum contaminant level (MCL), of 30 µg/l. Concentrations of dissolved total uranium slightly above the drinking water standard were also observed at other wells on-site along the northern property boundary.

Three monitoring wells installed approximately 620 feet north of the NFSS property boundary were sampled in July 2009 as part of the LOOW Phase IV Remedial Investigation. Uranium in these wells was below background and the safe drinking water standard. Based on this information, it can be inferred that uranium contamination in groundwater is bounded to within the Town of Lewiston (former LOOW Waste Water Treatment Plant) property. Groundwater is not a source of drinking water in this area and measures are underway to restrict public access to this area.

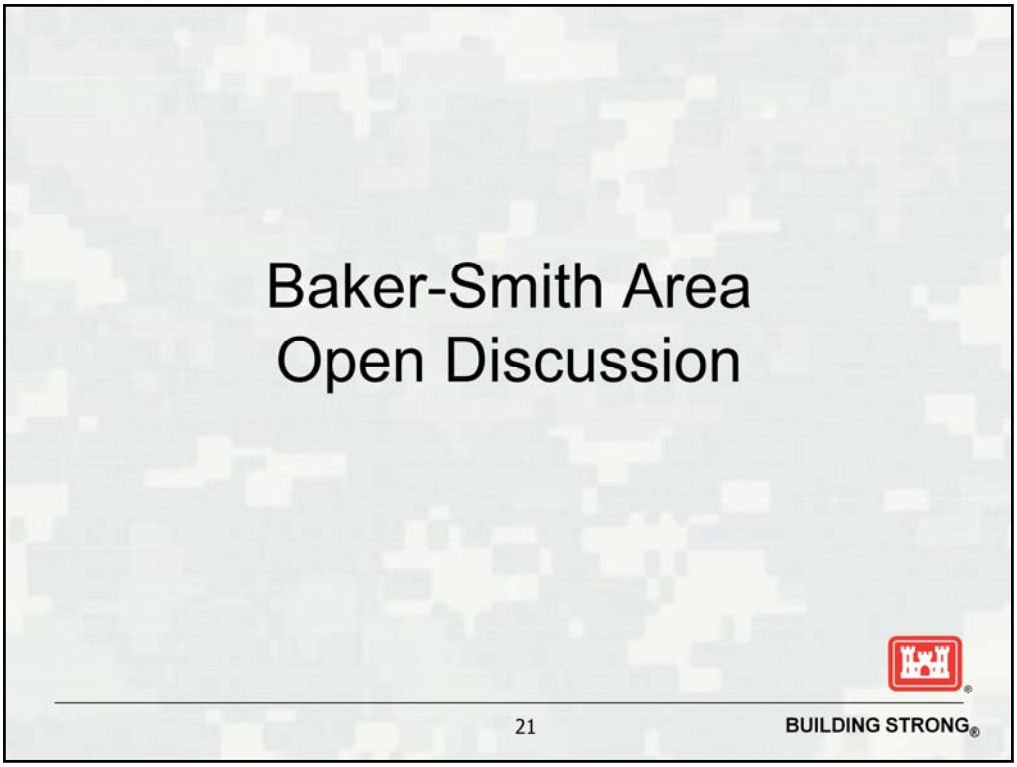
The Corps plans to perform additional field activities in support of continued monitoring of groundwater contamination in this area.



- The following animation will illustrate modeling results in the Baker-Smith Area. This particular simulation focuses on U-238. The spatial distribution of uranium in this area has been refined based on groundwater data collected as part of the RI Addendum activities. The slide shows the initial distribution of U-238 that was assigned in the model. This was based on the new groundwater data. Please note that the uranium contaminant distribution map, shown earlier in this presentation, represents total uranium. The model simulates the individual uranium isotopes, in order to simulate the radioactive decay and in-growth. Consequently, there are some differences between the maps.

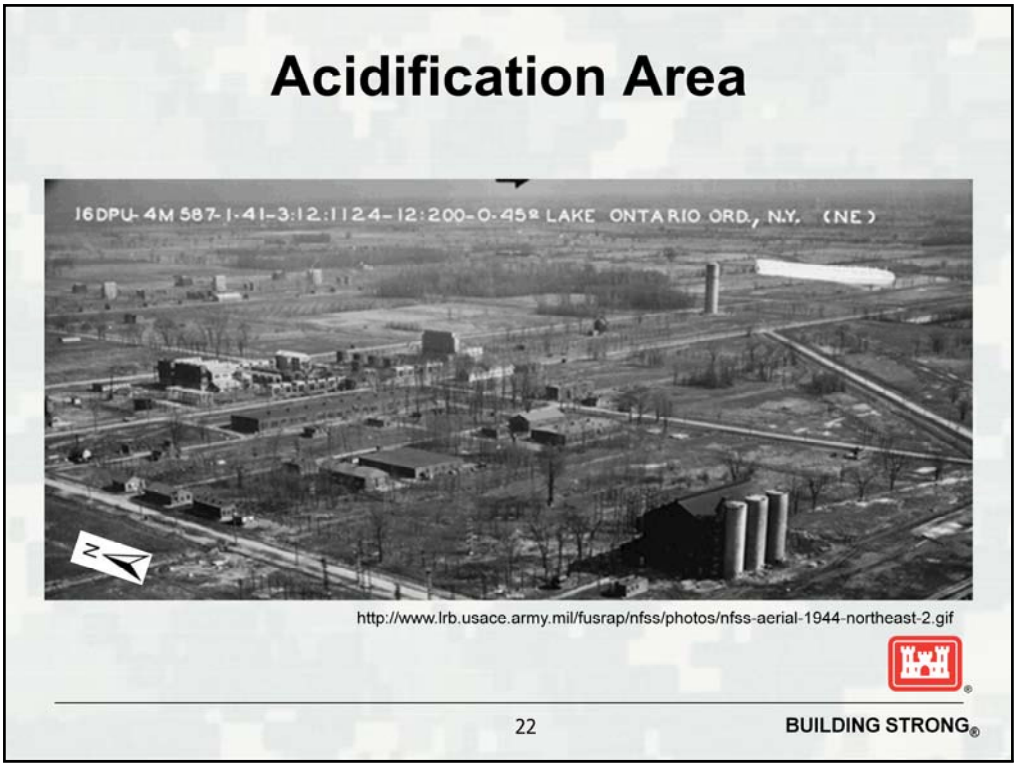
- The middle of the slide illustrates the predicted spatial distribution of U-238. A color scale showing the uranium concentrations is provided along with a time counter located at the right portion of the figure. The simulation was conducted to predict uranium concentrations 10,000 years into the future. Groundwater flow is to the northwest in this area.

- As the animation progresses, the changes in the predicted uranium distribution are barely discernable. This is because groundwater travels very slow in this area. In addition, uranium is adsorbed onto the clay within the Upper Clay Till, and the uranium migration is much slower than the groundwater velocity. The model predicts that there will be very little uranium migration in this area.



SLIDE 21 – Speaker: Hallie Serazin, SAIC

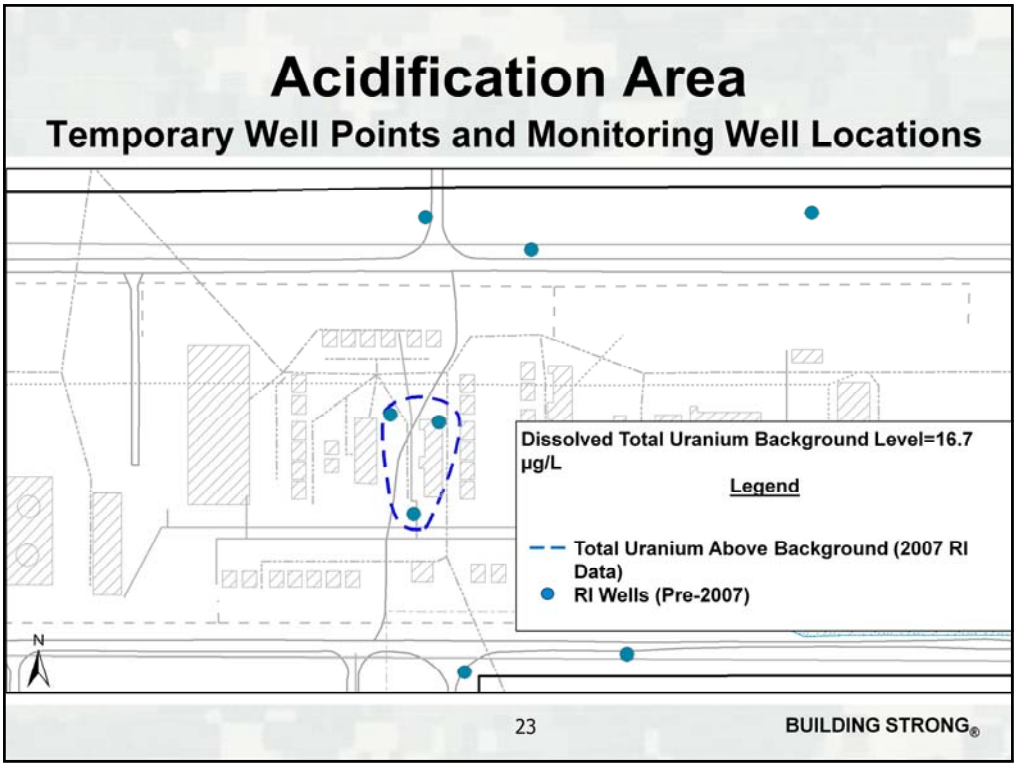
Open discussion of Baker-Smith Area Topics



Slide 22 – Speaker: Dave Kulikowski, Avesi

The Acidification Area, shown in the upper left of this photo, is located along the north-central portion of the NFSS property. During the LOOW operation, materials related to the manufacture of TNT were stored in this area. In the 1950s, uranium rods were stored in nearby buildings.

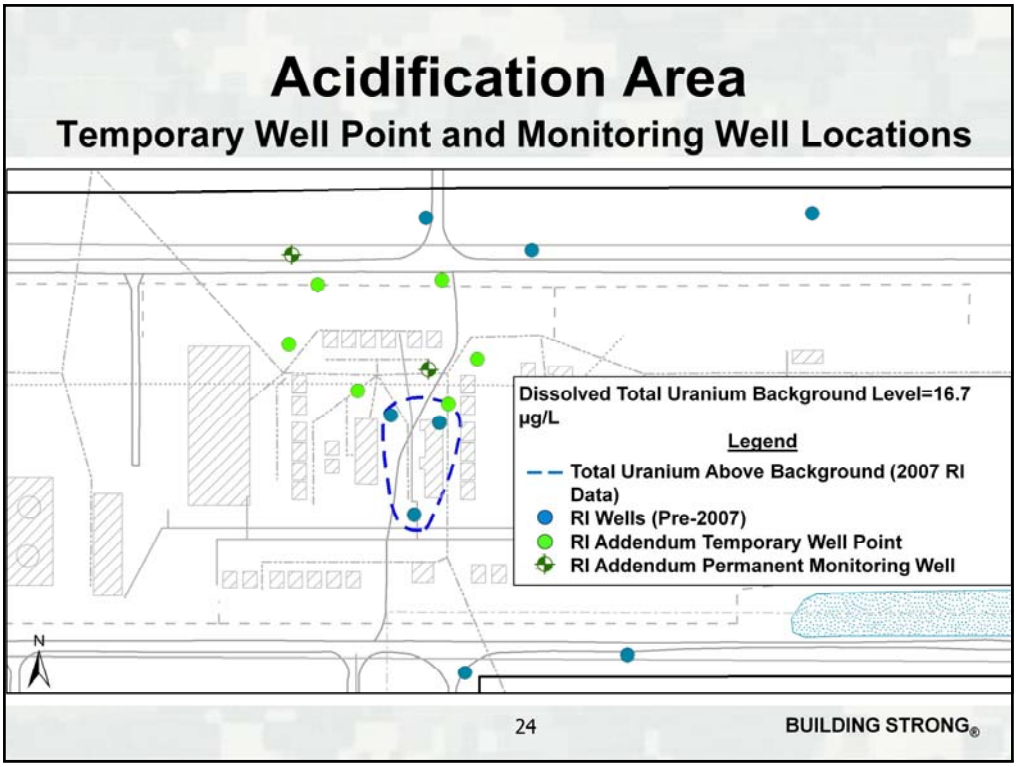
As part of the RIR Addendum activities, groundwater, soil, and soil gas sampling were conducted in this area to further investigate the presence of dissolved uranium and organic solvents. Although the source of the organic solvents was not established, their presence may be due to past storage activities of the military or the Atomic Energy Commission. As you can see in this this photo, this area of NFSS was heavily industrialized, and contamination currently observed here is likely the result of these past site operations.



SLIDE 23 – Speaker: Dave Kulikowski, Avesi

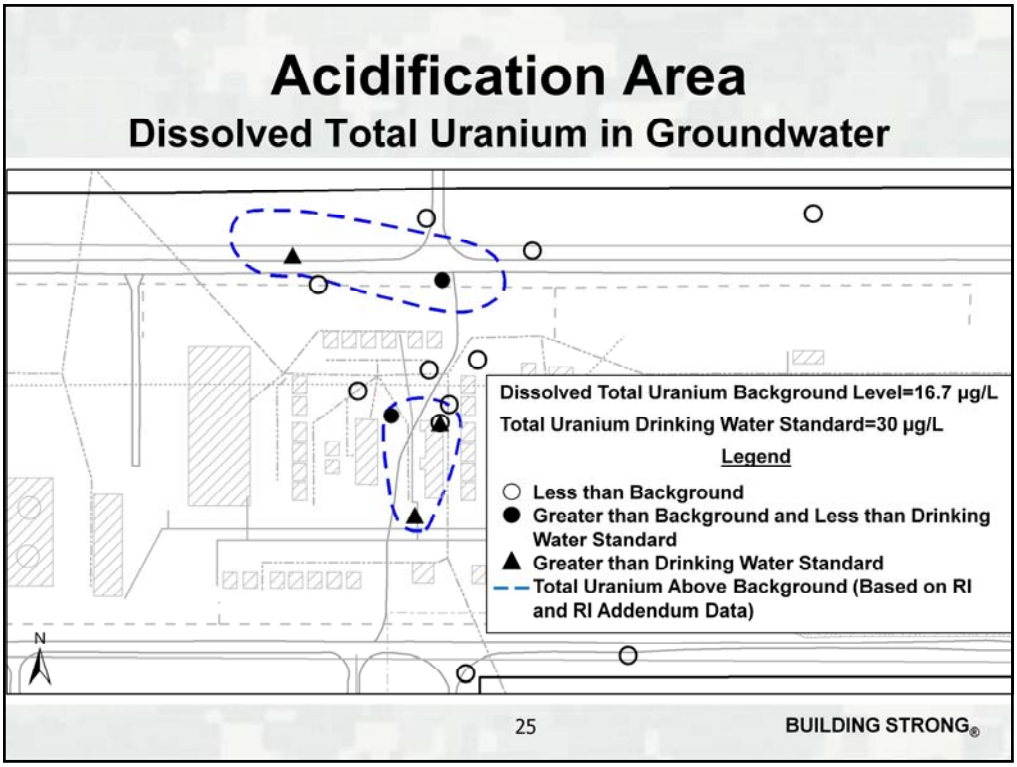
This figure shows the total uranium groundwater contamination identified during the 2007 RI. The blue dots identify the existing RI wells used to define the extent of uranium contamination in groundwater shown above.

During the RI Addendum field effort, investigation of known chemical and radiological contamination was the focus of sampling in the Acidification Area. The area of dissolved total uranium contamination in groundwater, identified during the first three phases of the RI, is shown in the central portion of the Acidification Area. This area was further defined by the RI Addendum study as shown on the next slide.



SLIDE 24 – Speaker: Dave Kulikowski, Avesi

Eight new sampling locations were installed at the Acidification Area to further refine the extent of contamination in groundwater. Six were installed as temporary well points, shown here as bright green dots, and two well locations, shown as green quartered circles, were converted to permanent monitoring wells that can be used to monitor this area of groundwater contamination in this area.



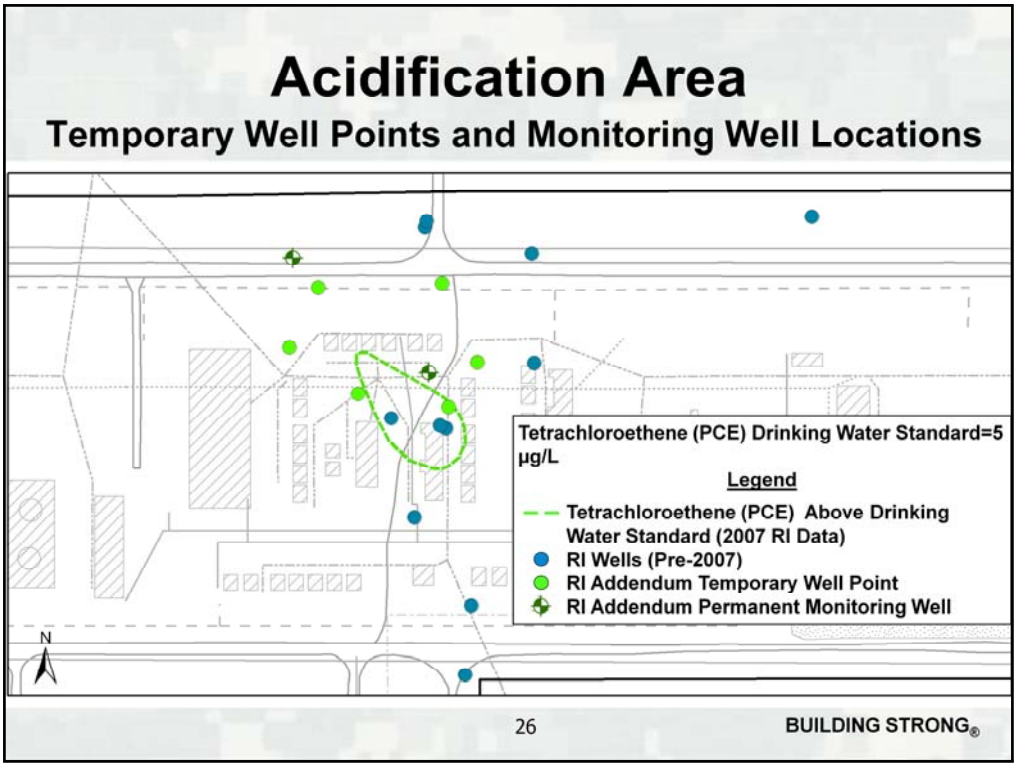
SLIDE 25 – Speaker: Dave Kulikowski, Avesi

The distribution of dissolved total uranium in groundwater in the Acidification Area is shown on this slide. During activities conducted for the RIR Addendum, an area of localized dissolved total uranium contamination was identified in groundwater along the northern property boundary.

RI sampling results indicate that dissolved total uranium is present at levels greater than the background level (16.7 µg/L) and safe drinking water standard (30 µg/L) in these two areas of groundwater contamination. On this figure, the hollow and filled circles represent groundwater that meets the drinking water standard (the hollow circles are below the background level and the filled circles are above background but below the drinking water standard). Triangles show groundwater samples that were above the drinking water standard. None of the uranium samples collected in the Acidification Area were more than double the drinking water standard.

The northwestern extent of this groundwater contamination is unknown. However, groundwater is not used as a source of drinking water and public access is restricted to the north of this area by the Chemical Waste Management (CWM) Chemical Services.

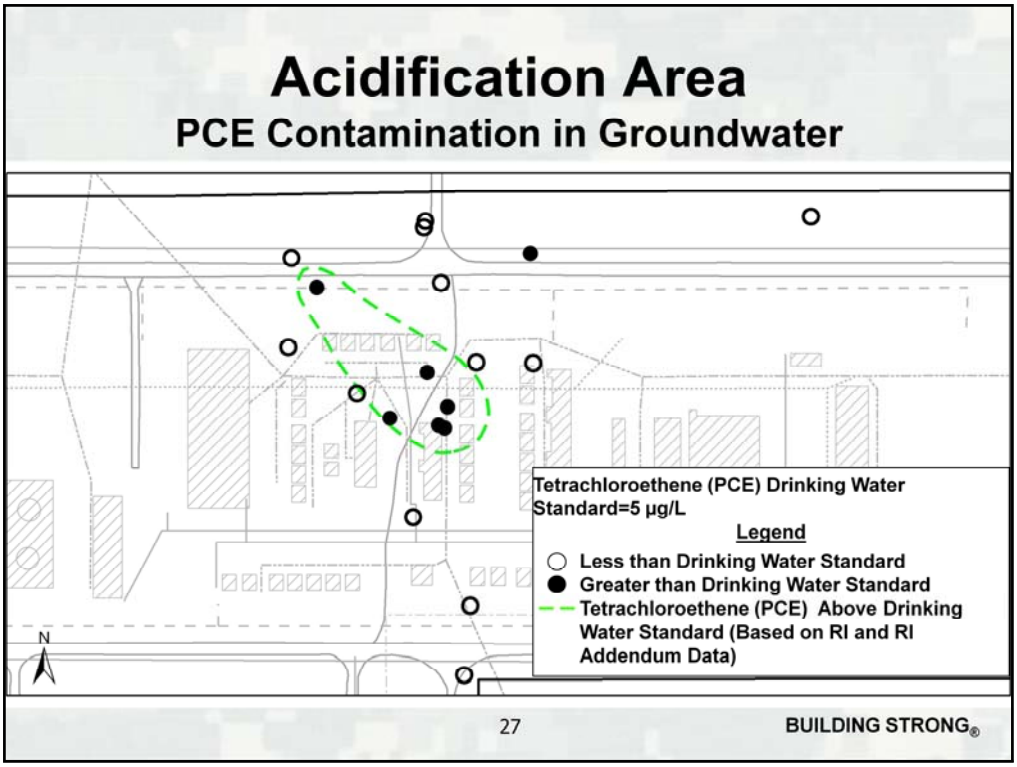
The Corps plans to perform additional field activities in support of continued monitoring of groundwater contamination in this area.



SLIDE 26 – Speaker: Dave Kulikowski, Avesi

During the 2007 RI, a southeast to northwest trending area of organic compound contamination in groundwater was identified in the Acidification Area. This localized area of groundwater contamination contains organic solvents, including tetrachloroethene (PCE) and its degradation products from the natural breakdown of PCE. Groundwater contaminated by PCE and its degradation products above the drinking water standard is within the NFSS site boundaries.

This figure shows the tetrachloroethene (PCE) groundwater contamination identified during the 2007 RI. The blue dots identify the existing RI wells used to define the extent of PCE in groundwater. As explained previously, six temporary wells (shown as bright green dots) and two permanent monitoring wells (shown as green quartered circles) were installed in the Acidification Area during the RI Addendum field activities. The RI Addendum wells were installed in the Acidification Area to further define extent of PCE in groundwater.

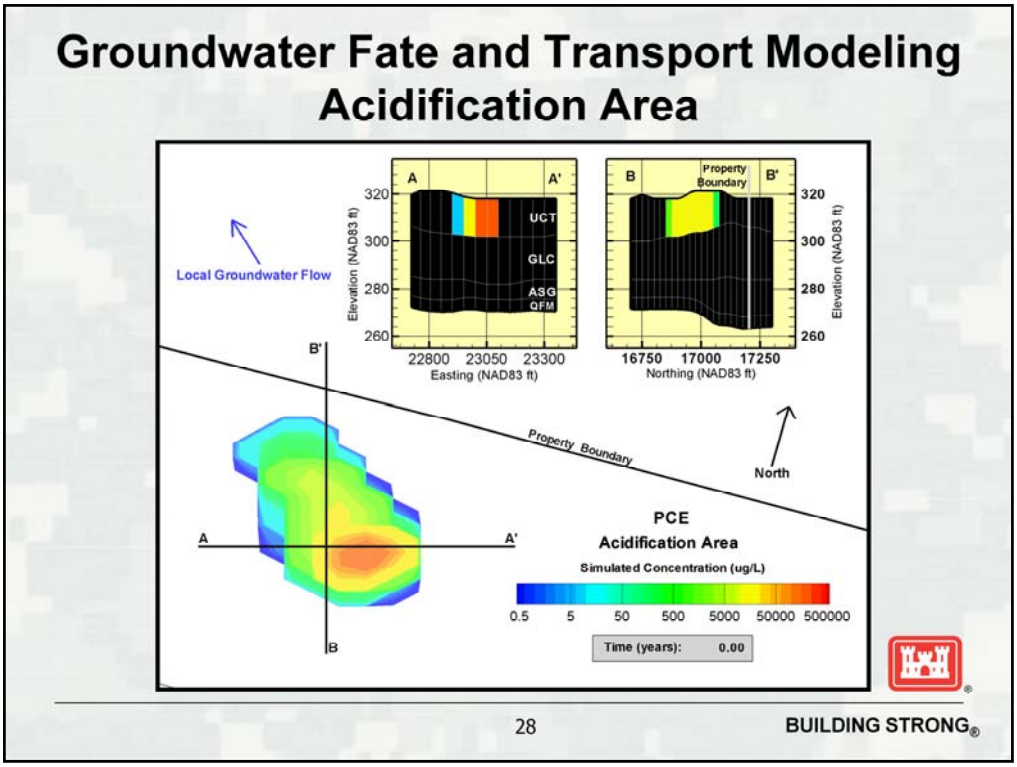


SLIDE 27 – Speaker: Dave Kulikowski, Avesi

The current distribution of PCE in groundwater is shown on this slide. On this figure, the hollow circles are below the drinking water standard, or MCL of 5 ug/L, and the filled circles are above the drinking water standard.

RI Addendum sampling results indicate that PCE and its degradation products are present in both surface and subsurface soil within the boundary of the groundwater contamination area. The source of this organic groundwater contamination is near the central portion of the Acidification Area where visible dense (heavier than water), non-aqueous (not dissolved) phase liquid (DNAPL) was observed during sampling activities. The area of organic compound groundwater contamination extends to within approximately 150 feet of the northern property boundary, but does not extend off-site.

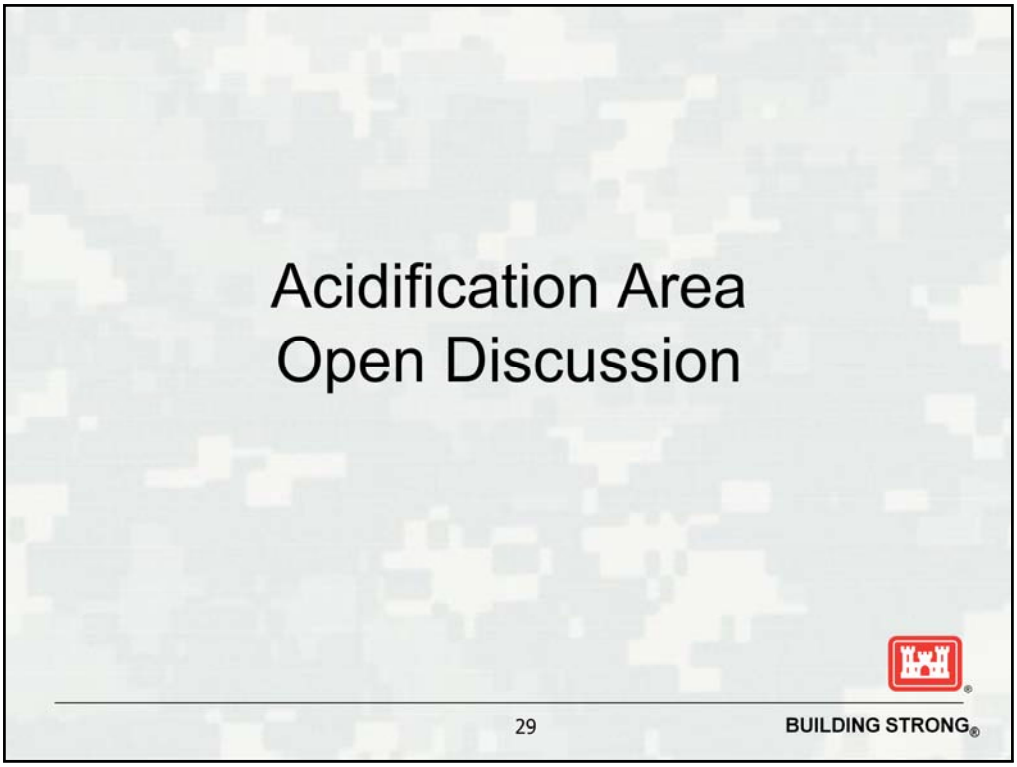
The Corps currently monitors the organic compound groundwater contamination through the Environmental Surveillance Program by collecting semi-annual groundwater samples from monitoring wells north of the contaminated groundwater area. It is important to note that groundwater in this area is not used as a source of drinking water and CWM Chemical Services property is located to the north, where public access is restricted. The Balance of Plant Feasibility Study will address the remedial alternatives for the source of the contamination, PCE and its degradation products present in soil.



- The following animation will illustrate modeling results in the Acidification Area. This simulation focuses on tetrachloroethene, also known as PCE. PCE is a solvent that was widely used in the past. It often degrades into other solvents that are also present in the groundwater in the Acidification Area. The degradation occurs as a result of microbial activity. As discussed earlier in the presentation, the model was recently revised in order to change the way that the PCE source is represented in the model. In the revised simulation, a constant concentration was specified in the model to represent the highest PCE concentrations detected in groundwater. The concentration in this area does not decline as the model simulation progresses. This is a conservative way of simulating this source term. It was simulated this way so we can determine the maximum extent of the solvent contamination.

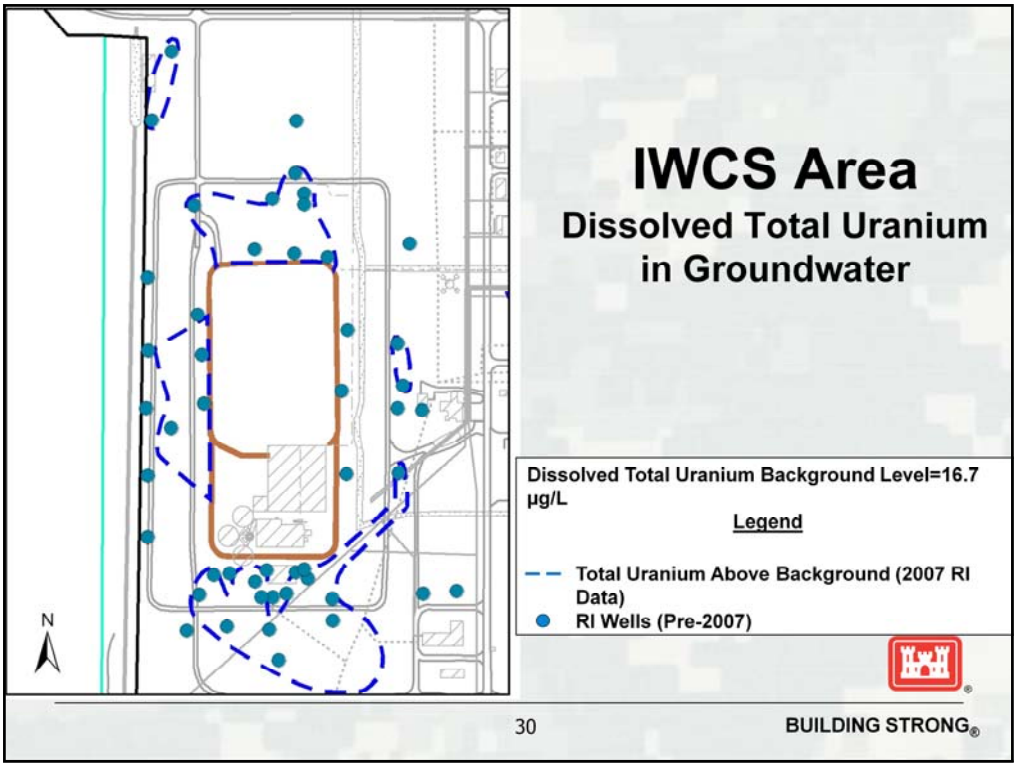
- This animation contains two cross-sections, a contaminant distribution map, a color scale, and a time counter. The color scale shows PCE concentration ranging from 0.5 to 500,000 ug/L. Groundwater flow is to the northwest.

- As the animation progresses, PCE in the northwestern portion of the Acidification Area expands slightly then slowly disappears. After approximately 180 years, the PCE plume doesn't change. As the PCE slowly migrates from the source area, concentrations are reduced by natural degradation processes. Due to the low groundwater velocities, a large plume is not expected to be developed in this area. Note that the model predicts that low concentrations of PCE are predicted to migrate into the lower water-bearing units. This vertical migration is predicted to occur, because PCE is fairly mobile in groundwater, the source term has been prescribed as a constant concentration, and concentrations in the Upper Clay Till are very high.



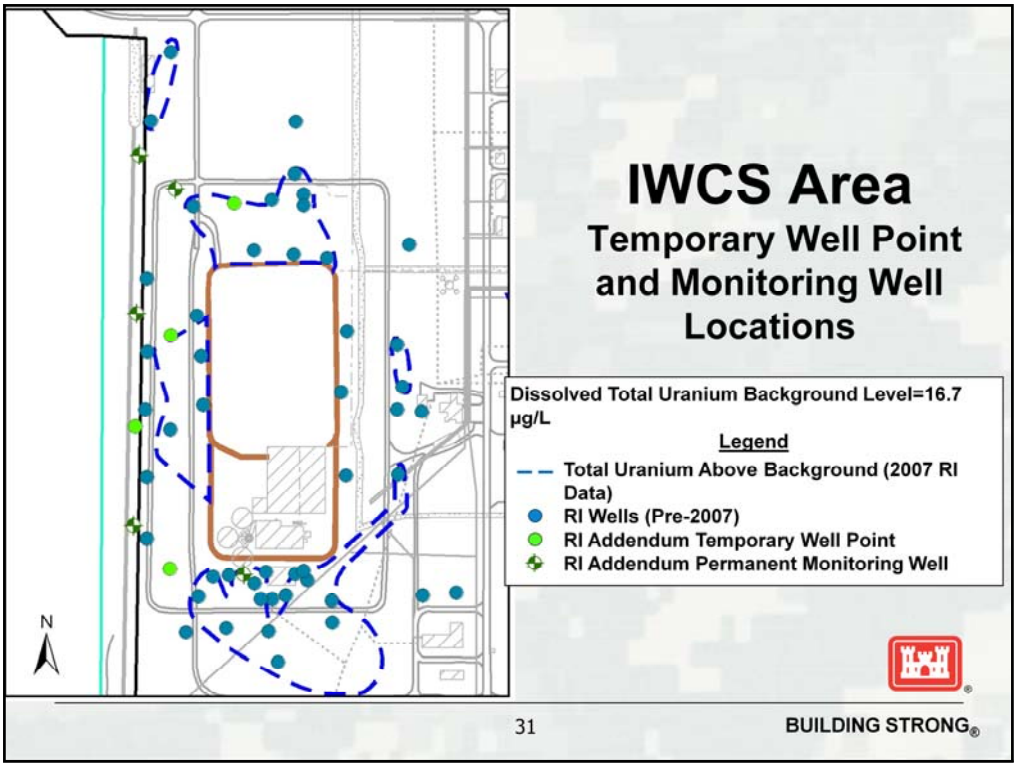
SLIDE 29 – Speaker: Dave Kulikowski, Avesi

Open discussion of Acidification Area Topics



SLIDE 30 – Speaker: Dave Kulikowski, Avesi

This slide also shows the area of dissolved total uranium present in groundwater near the IWCS as identified by the 2007 RI.

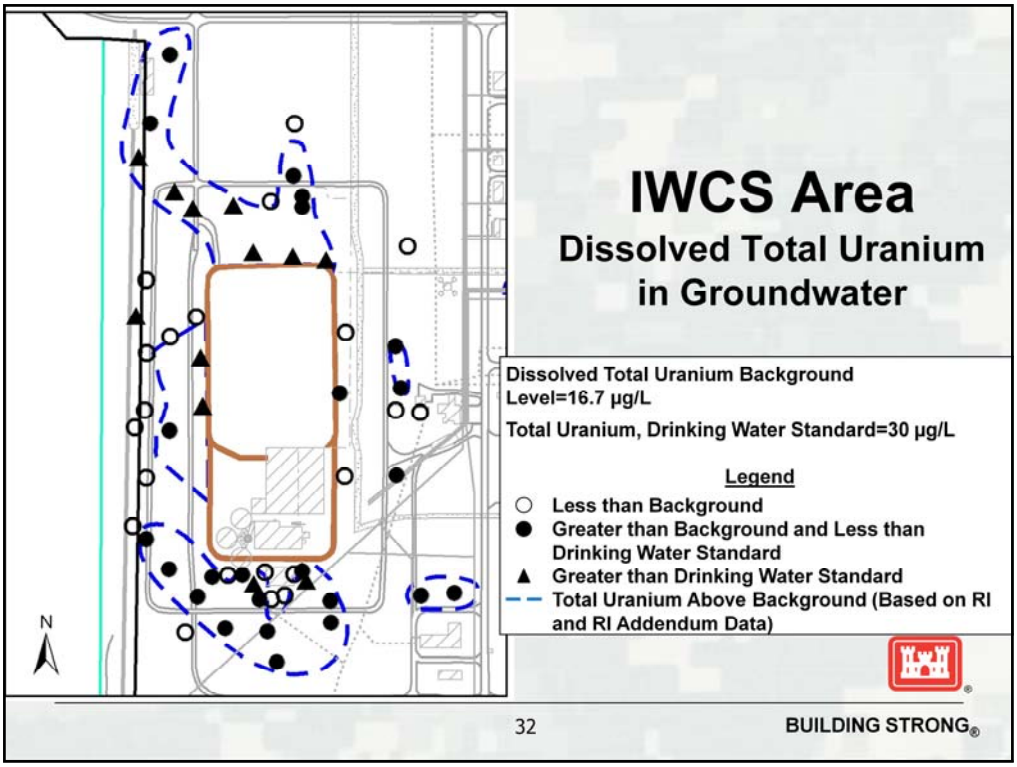


SLIDE 31 – Speaker: Dave Kulikowski, Avesi

During the RI Addendum field activities, 4 temporary well points and 5 permanent monitoring wells were installed in the vicinity of the IWCS. This figure shows the locations of temporary well points (shown as bright green dots) and permanent monitoring wells (shown as green quartered circles) installed in the vicinity of the IWCS during the RI and RI Addendum field activities.

These wells were used to further evaluate the radiological groundwater contamination in the vicinity of the IWCS and to investigate the potential presence of groundwater contaminants off-site along the western property boundary. This slide also shows the area of dissolved total uranium present in groundwater near the IWCS as identified by the 2007 RI.

In initial interpretations, pipeline water samples were used to estimate the extent of dissolved total uranium in groundwater south-southeast of the IWCS. However, this appears to be a poor approximation tool because the pipeline does not show what is in groundwater. For this reason, sample data collected from pipelines and manholes have been excluded from updated groundwater results, as shown on the next slide.



SLIDE 32 – Speaker: Dave Kulikowski, Avesi

This slide shows the current understanding of where dissolved total uranium occurs in groundwater. On this figure, the filled and hollow circles represent groundwater that meets the drinking water standard (the hollow circles are below the background level, and the filled circles are above background but below the drinking water standard). Triangles show groundwater samples that were above the drinking water standard.

The extent of the groundwater contamination along the west side of the IWCS is well characterized and delineated using densely spaced sampling points. The groundwater contamination on the west side of the IWCS, identified during early phases of the Remedial Investigation, remains unchanged. The concentrations of uranium detected in wells and temporary well points between the IWCS and the West Drainage Ditch in this area are less than or near background levels. Recent surface water sampling results from 2008-2010 indicate that dissolved total uranium concentrations are currently below the background level at three sampling locations along the West Drainage Ditch.

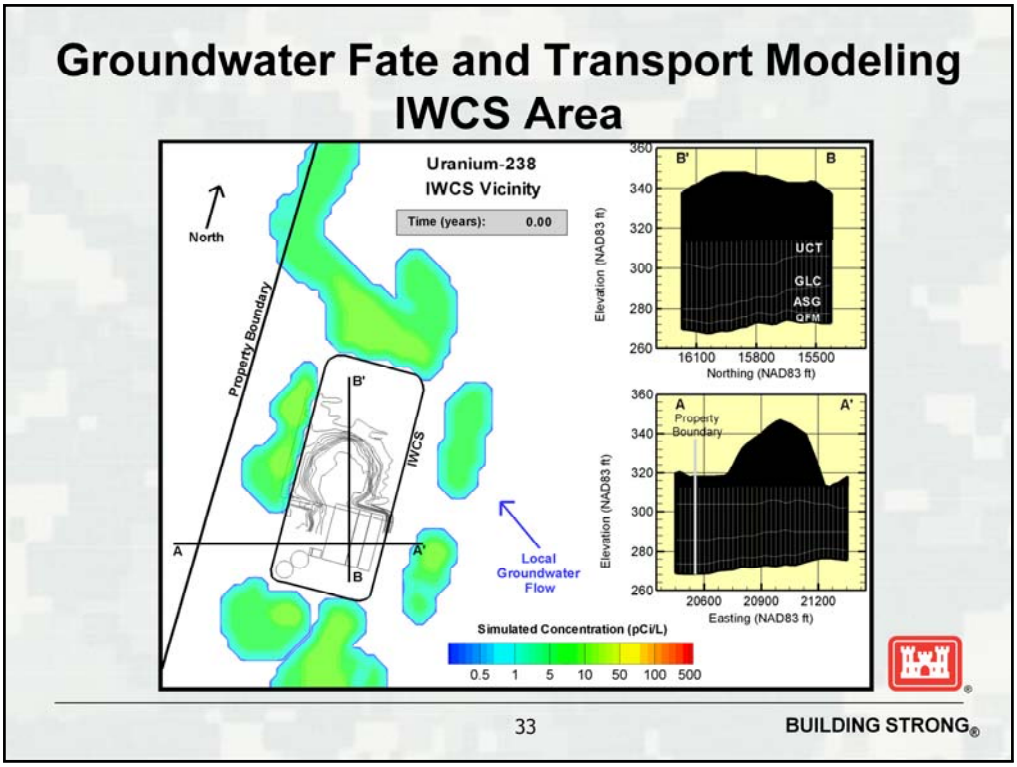
By excluding the pipeline data that does not apply (as discussed on the previous slide), dissolved total uranium in groundwater south of the IWCS is now interpreted to be more constrained to the southern portion of the IWCS near former Building 409.

RI Addendum sampling results indicate that the dissolved total uranium groundwater contamination extends further to the northwest; however, contamination does not extend to the West Drainage Ditch.

Some radiological constituents are still present in the surface and subsurface soil in the area south of the IWCS. These isolated soil locations could potentially contribute to groundwater contamination over time.

Available site operational information and environmental investigative data indicate that groundwater contamination surrounding the IWCS is the result of historic site operations and past waste storage practices. Most of the soil contamination that contributed to current groundwater contamination was removed during the remedial efforts performed by the Department of Energy in the 1980s. This suggests that the waste stored inside the IWCS is not contributing to groundwater contamination. This will be discussed later in this presentation.

Although data indicates that the IWCS is performing as designed, the Corps intends to install additional monitoring wells south of the IWCS as part of field work for the Balance of Plant Feasibility Study. Specifically, the Corps would like to further investigate the area where one sampling point, TWP833, exhibited an elevated concentration of uranium in groundwater. Last week, the Corps had a conference call with a few members of the community, and asked these community members to identify locations south of the IWCS where they would like to see additional wells installed. These community members readily accepted the Corps' offer and the Corps looks forward to receiving their input.

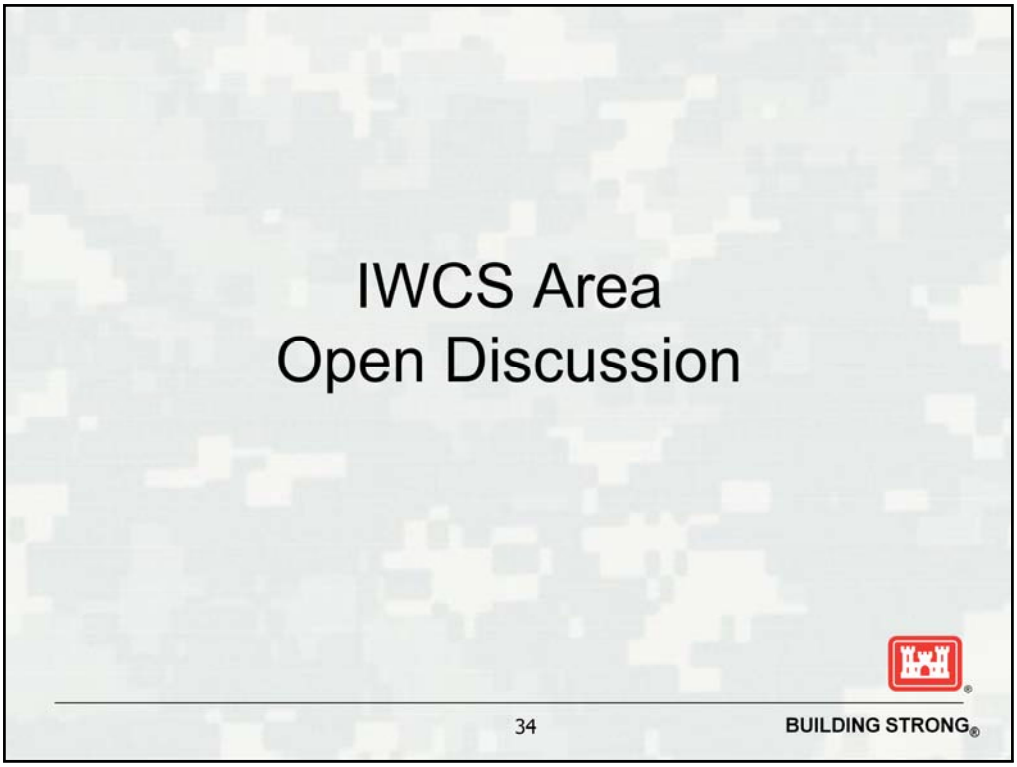


- The following animation will illustrate modeling results in the IWCS Area. This simulation focuses on U-238. One source of U-238 in this area is the uranium that is currently detected in groundwater. This is currently illustrated on the slide. The spatial distribution of U-238 was revised to reflect the recent data collected as part of the RI Addendum work. Other sources of U-238 are the waste in the IWCS and BOP soil contamination. The model simulates all three of these sources of contamination.

- Although the containment structure has been effective at mitigating the transport of contaminants within the cell, there is a small amount of water that infiltrates through the clay cap. With time, the model predicts that some contaminant migration will occur through the IWCS.

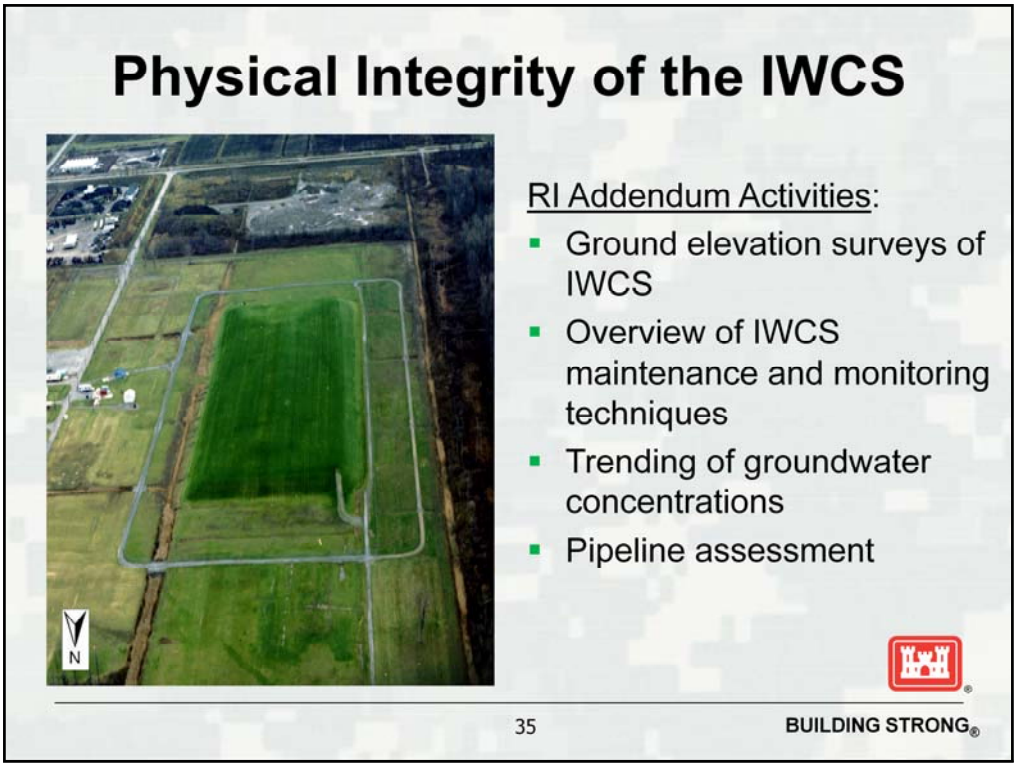
- As with the earlier animations, this animation contains two cross sections, a contaminant distribution map, a color scale, and a time counter. The color scale shows U-238 concentrations ranging from 0.5 to 500 pCi/L. The maximum predicted concentration in groundwater occurs at 10,000-years and is 27,052 pCi/L beneath the IWCS. Groundwater flow is to the northwest.

- After approximately 100 years, the model predicts that low levels of U-238 will migrate from the IWCS to the water table. The model predicts that the screening level for U-238 will be exceeded after 200 years beneath the IWCS. The model predicts some lateral spreading of the U-238. However, the U-238 is not expected to migrate significant distances over 10,000 years.



SLIDE 34 – Speaker: Dave Kulikowski, Avesi

Open discussion of Acidification Area Topics



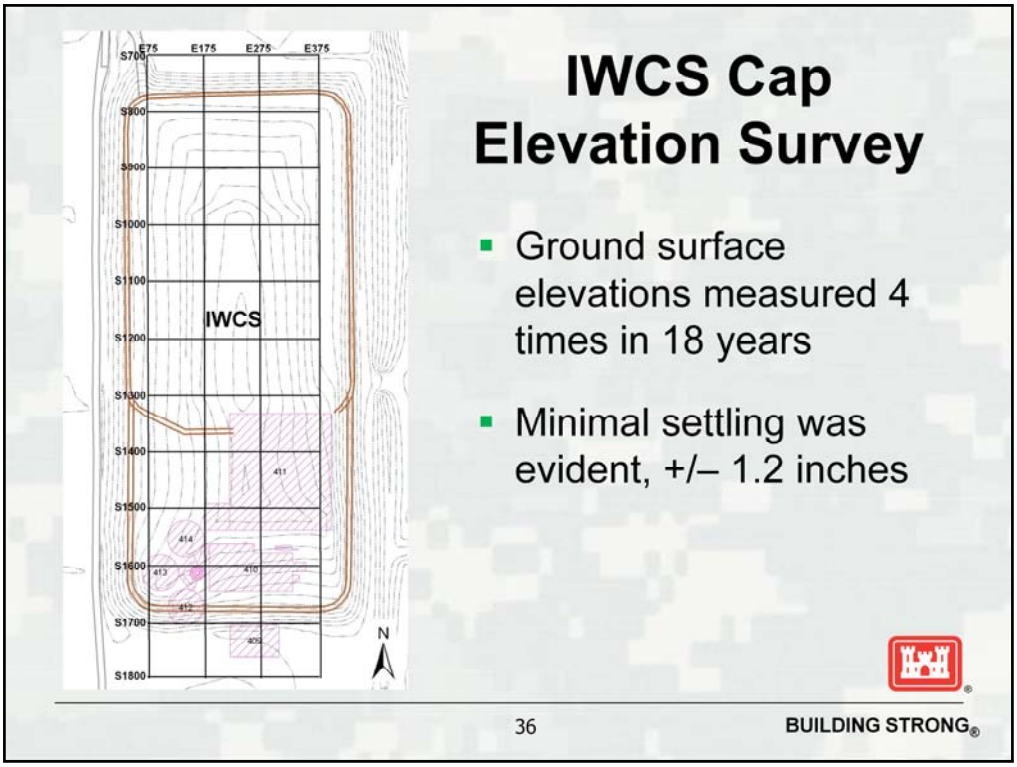
SLIDE 35 – Speaker: Hallie Serazin, SAIC

We received several questions from the community regarding the integrity of the IWCS, such as:

- Is the IWCS cap settling?
- How is the cap maintained to be sure that minimal rainwater gets in and minimal radon gets out?
- What is the source of the dissolved uranium groundwater areas observed outside of the IWCS?
- Do underground pipelines within the IWCS present a pathway for release of the radiological materials placed in the IWCS?

The RI Addendum examined several lines of evidence to assess the integrity of the IWCS.

Let's look at each of these RI Addendum activities listed in the slide in more detail.



SLIDE 36 – Speaker: Hallie Serazin, SAIC

The RI Addendum examined ground surface elevation data collected in the vicinity of the IWCS. Since the IWCS was completed in 1991, ground surface elevations have been measured 4 times (1991, 1996, 1999, and 2009). A comparison of results from the first 3 surveys was presented in the RI Report. The RI Addendum adds results from the 4th survey and compares results from all 4 survey events.

In this figure you can see former structures enclosed within the IWCS, the IWCS cut-off wall, and the survey grid. Measurements were taken at the corners of each block.

All 4 surveys show minimal settling of the IWCS cap. The average change in elevation across all 4 surveys was +/- 1.2 inches which demonstrates that the IWCS cap is stable.

SLIDE 37 – Speaker: Hallie Serazin, SAIC

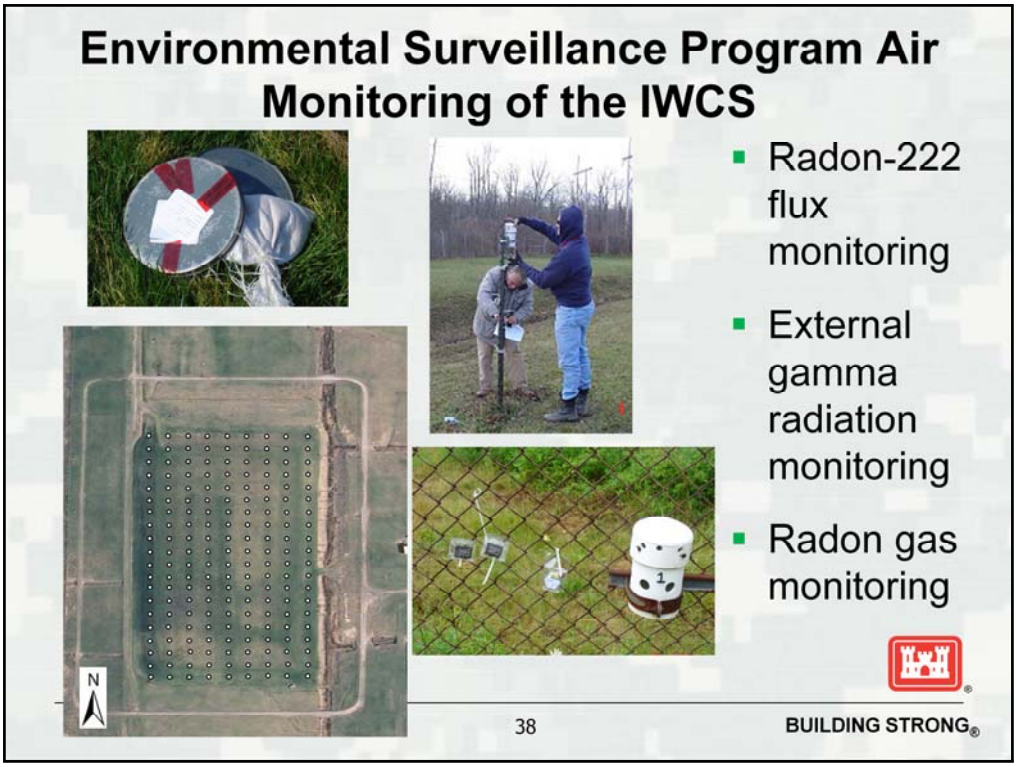
The RI Addendum included a summary of cap maintenance activities and Environmental Surveillance Program monitoring results.

The IWCS cap consists of various layers of materials, including clay, and is designed so that minimal rainwater gets in and minimal radon gets out.

Visual cap inspections are conducted at least once a month. To date, no issues have been discovered during cap inspection. The inspections include looking for:

- ponded water,
- visible settling,
- desiccation cracking,
- excessive weeds,
- insects or pests, and
- burrowing animals.

A layer of grass covers the IWCS to prevent erosion and minimize the potential for the cap to dry out and crack. The grass layer is maintained through aeration, dethatching, fertilization, irrigation, and other turf maintenance procedures, some of which you see here.



SLIDE 38 – Speaker: Hallie Serazin, SAIC

The NFSS Environmental Surveillance Program was initiated by the Department of Energy in 1981 - prior to construction of the IWCS. The program was established to monitor environmental media and to ensure protection of human health and the environment. The Environmental Surveillance Program has been expanded over time and currently monitors groundwater, surface water, sediment, and air for radiological parameters such as radon and external gamma radiation. New York State Department of Environmental Conservation collects split samples with USACE at various locations during the semiannual radiological monitor exchange.

Key components of the Environmental Surveillance Program that provide the best indication of cap performance include:

- radon-222 flux monitoring,
- external gamma radiation monitoring, and
- radon gas monitoring.

Radon-222 Flux Monitoring

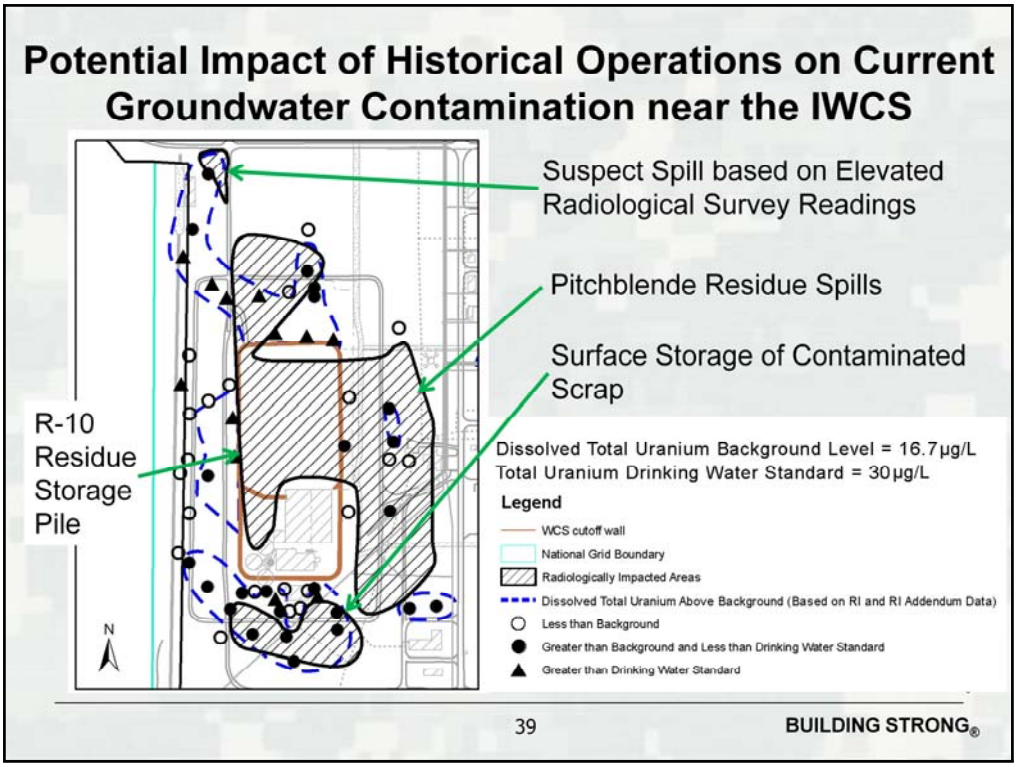
- Radon flux monitoring is the most direct indicator of cap performance and integrity because it is measured using 183 radon flux canisters placed directly on the IWCS surface. One of these canisters (top left) and the locations where they are placed on the IWCS (bottom left) are pictured here.
- Radon-222 levels are comparable to background levels and demonstrate the continued effectiveness of the IWCS cap in reducing the potential for radon migration and exposure.

External Gamma Radiation Monitoring

- External gamma radiation is monitored using radiation detectors located around the IWCS and at the perimeter of the site. One of the contributors to gamma radiation is Radium-226.
- An external gamma radiation detector is pictured here (bottom right, right-hand side). The detectors are used to measure external gamma radiation dose rates and are switched out twice a year.
- External gamma results continue to be at or near background levels and are well below the Department of Energy guideline level (100 mrem/year) for all pathways, excluding radon.

Radon Gas Monitoring

- Inhalation is the most serious pathway for exposure to radon so radon gas monitoring is performed at 5.6 feet above ground level. This height is used to represent the human breathing zone.
- Radon gas monitoring is conducted using a Radtrak® detector, which is the white canister shown in the lower right-hand picture. The top right photo shows one of the detectors being changed.
- Results of the radon gas monitoring continue to be well below the Department of Energy off-site limit of 3.0 pCi/L above background.



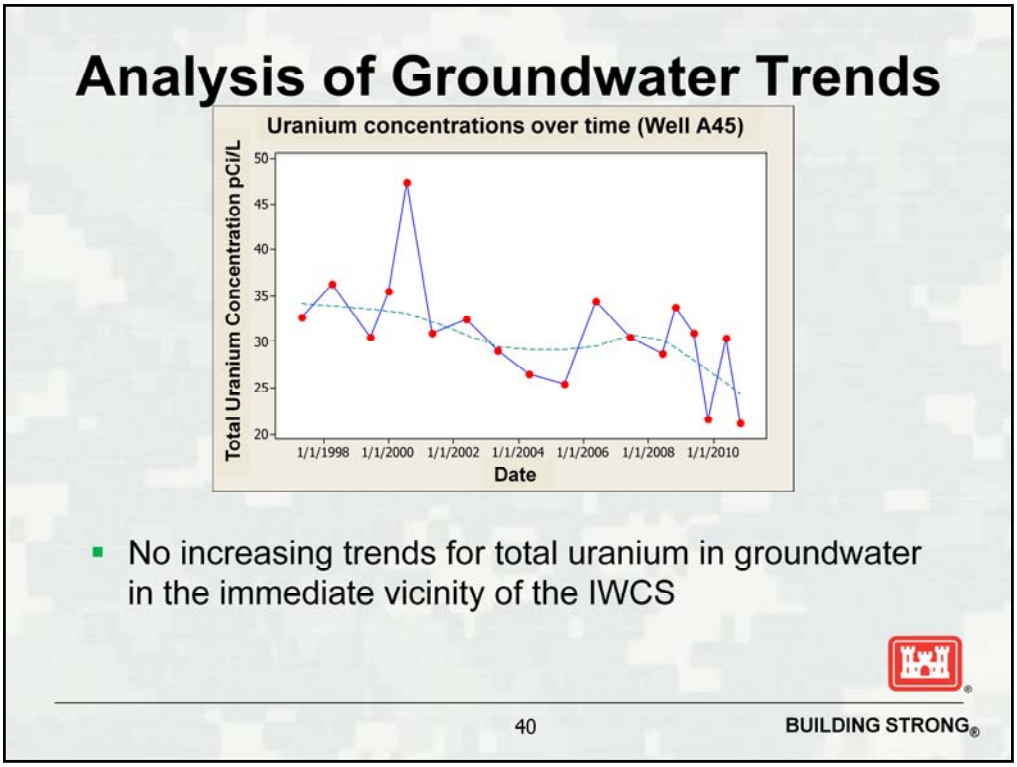
SLIDE 39 – Speaker: Hallie Serazin, SAIC

To evaluate the possibility that the wastes stored within the IWCS are contributing to groundwater contamination, the RI Addendum included a review of historic aerial photographs and groundwater trending data. The data and historic evidence indicate that uranium contaminated groundwater areas in the vicinity of the IWCS came from activities prior to IWCS construction. These releases were later cut-off by installation of the surrounding cut-off wall. The RI Addendum provides additional support to the conclusions drawn by the RI Report.

This figure shows how closely the historic operational area correlate with existing impacts to groundwater. The figure shows the areas that DOE estimated to be radiologically contaminated prior to remediation. The area of actual contamination was larger, and when DOE actually excavated the contamination, the areas that were removed were more extensive than shown on the figure. These additional removals also match the footprint of the uranium-contaminated groundwater.

The noted operational releases include:

- A suspect spill north of the IWCS that was identified by radiological surveys of the area,
- Runoff from the former R-10 storage pile west of the IWCS (the R-10 pile is now enclosed within the IWCS),
- Spills of pitchblende residues (pitchblende is an ore of uranium) north and east of the IWCS
- Surface storage areas for contaminated scrap south of the IWCS.



SLIDE 40 – Speaker: Hallie Serazin, SAIC

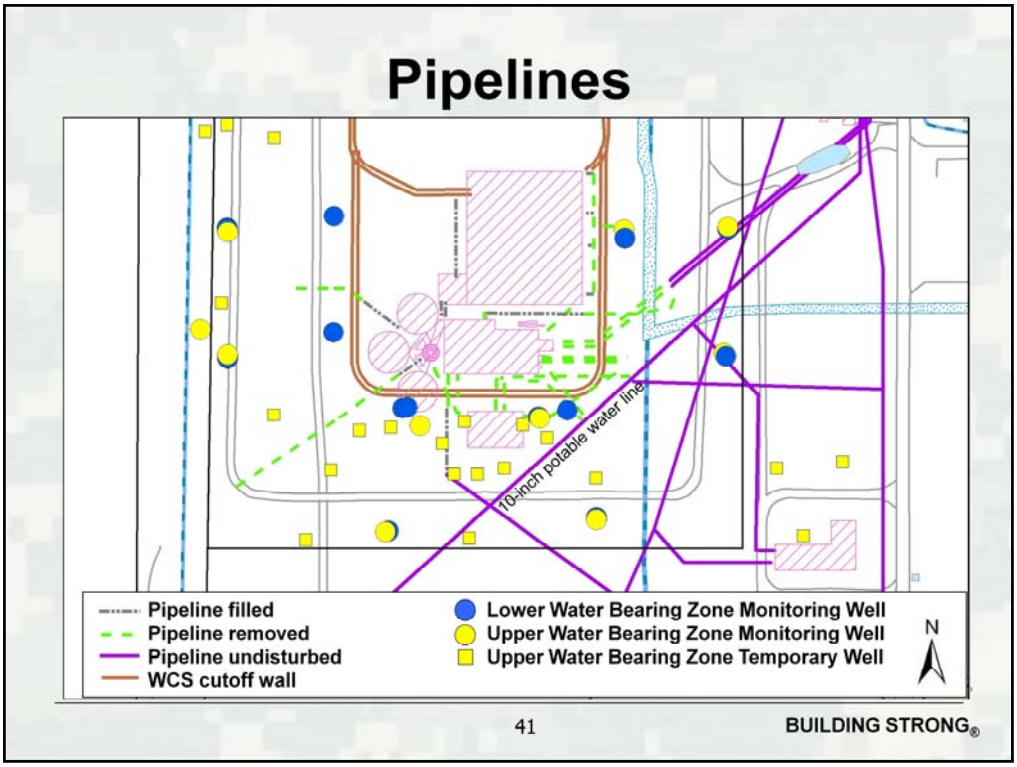
If the IWCS was not performing as designed, groundwater sampling results at wells used to monitor cell integrity would be expected to show increasing concentrations of radionuclides over time. To further assess this possibility, the RI Addendum looked for long-term concentration trends (changes in concentration over time) in groundwater using data collected from 1997 through 2010. No clear trends of increasing radionuclide concentrations were observed in the immediate vicinity of the IWCS.

The RI Addendum looked for evidence of increasing or decreasing trends for uranium and radium in groundwater near the IWCS. This slide shows an example of a graph used to study trends of uranium in groundwater. The data for this well, A45, shows a declining trend for uranium concentrations. Well A45 is located just outside the slurry wall on the northeastern corner of the IWCS. Long-term trends in groundwater data for total uranium show steady-state (consistent) to declining concentration levels, which is evidence that the IWCS is performing as designed.

The lack of clear increasing trends for uranium and radium in groundwater near the IWCS indicates that the uranium contaminated groundwater areas adjacent to the IWCS are not the result of leakage from the IWCS. Instead, they are artifacts of past contamination established prior to IWCS construction and installation of the IWCS cut-off wall.

The Corps plans to conduct additional field activities during the Balance of Plant Feasibility Study, including investigation of the integrity of the underground utility lines south and east of the IWCS. In the meantime, the Corps will continue to closely monitor groundwater contamination near the IWCS as part of the ongoing Environmental Surveillance Program.

Enhancements already made to the Environmental Surveillance Program in the Fall of 2010 include the addition of 21 groundwater monitoring well locations. Seventeen of these 21 wells are located in the vicinity of the IWCS, which will allow for better analysis of groundwater trends.

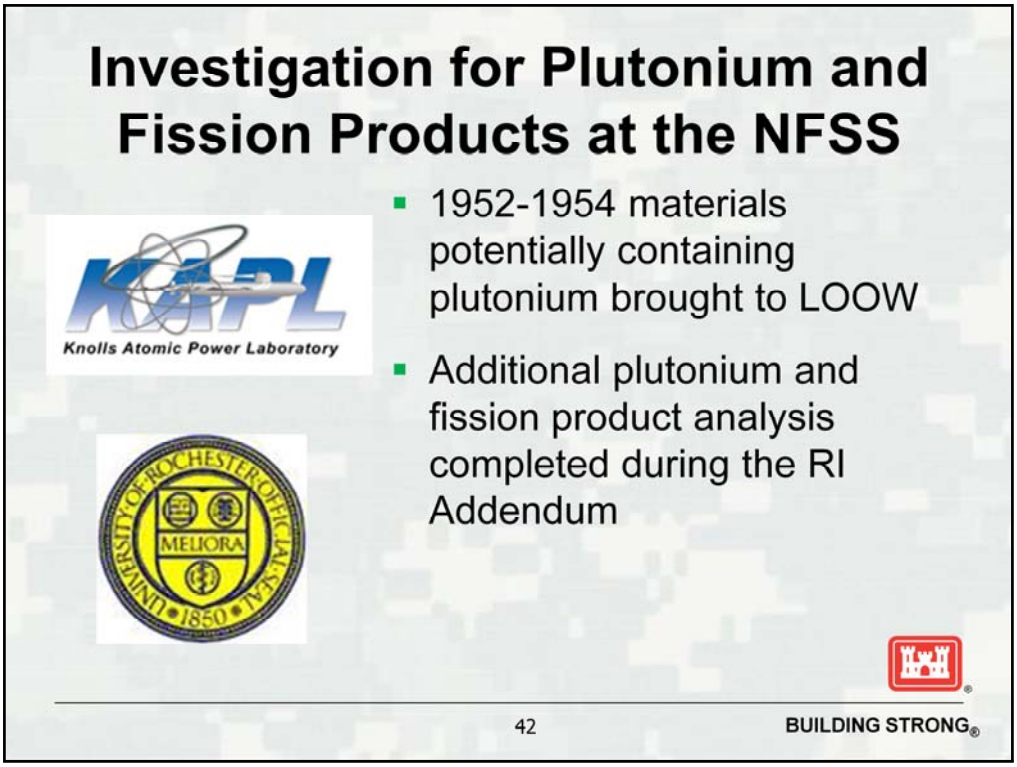


SLIDE 41 – Speaker: Hallie Serazin, SAIC

In further evaluating pipelines in the vicinity of the IWCS, the RI Addendum first looked at "as-built" drawings for the former LOOW freshwater treatment plant buildings which are located in the southern section of the IWCS. These drawings show that the pipelines were built without bedding materials (such materials may act as conduits for water and therefore pathways for contaminant release). In addition, the drawings show that the LOOW freshwater treatment plant building foundations and connecting pipelines are located in the upper clay till. The clay's low permeability reduces the potential for contaminant releases outside of the pipelines. These conditions support the idea that flow outside of the pipelines is very low.

The RI Addendum also looked at historic photos and engineering drawings for the IWCS. These documents show the pipelines connecting the former LOOW freshwater treatment plant buildings were removed or filled, and the ends plugged. This further reduces the possibility of contaminant transport from the pipelines within the IWCS (DOE 1986). Pipelines that extended across the path of the IWCS cut-off wall were cut-off inside and outside of the cut-off wall and portions were removed during IWCS construction, so the pipelines are not transporting contamination through the IWCS cut-off wall.

As previously mentioned, last week the Corps had a conference call with some members of the community. One item that continues to be a community concern is the pipelines. Again, as part of field work for the Balance of Plant Feasibility Study, the Corps intends to investigate areas in and around the pipelines to address community and stakeholder concerns and to determine whether pipelines may be contributing to groundwater contamination in certain on-site monitoring wells (e.g., OW11B). This additional work could include test pits and monitoring wells.

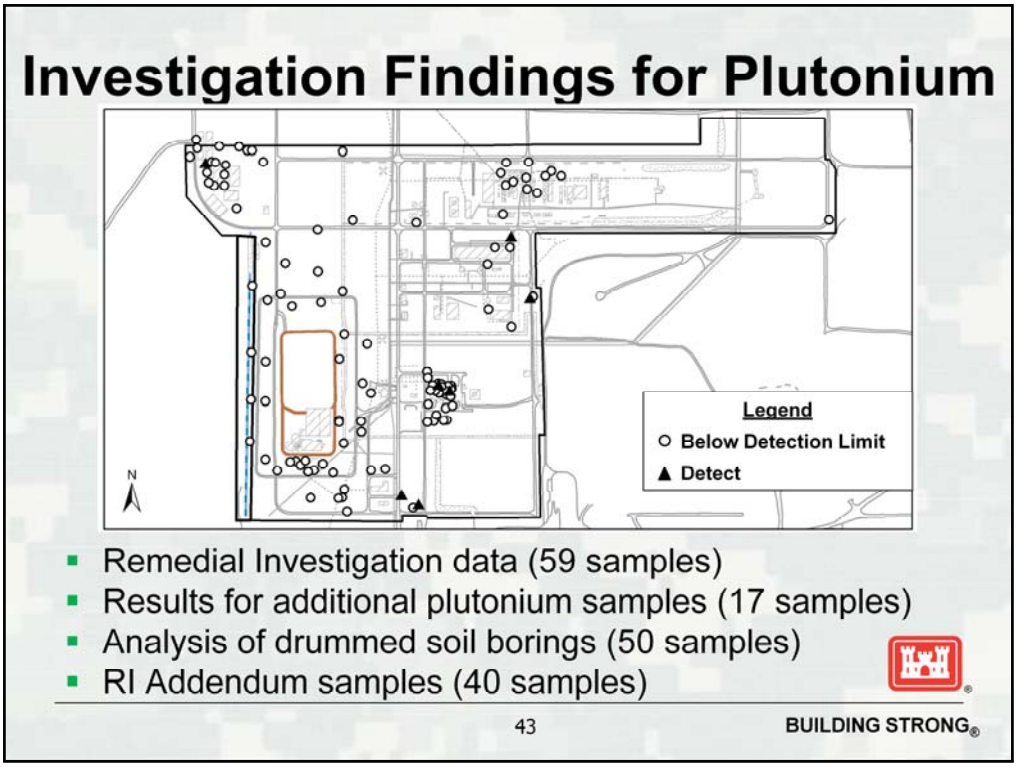


SLIDE 42 – Speaker: Hallie Serazin, SAIC

Historic records indicate that between 1952 and 1954, radiologically contaminated materials that may have contained plutonium and other fission products were brought to the NFSS from the Knolls Atomic Power Laboratory, or KAPL, in Schenectady, NY and from the University of Rochester in Rochester, NY. Historic records also indicate that in the late 1950's, a majority of the KAPL waste stream was shipped to burial grounds at the Oak Ridge National Laboratory in Tennessee. However, since comments regarding the potential for plutonium and fission products at the NFSS were received, this issue was further investigated during the RI Addendum.

The predominant radionuclides expected at the NFSS include radionuclides from the decay series for naturally-occurring uranium. Since plutonium is not part of these decay series, the RI database included limited analysis for isotopic plutonium. During the RI, plutonium analysis was completed for 59 samples collected around areas where KAPL materials had been stored, specifically the Baker-Smith Area and Building 401.

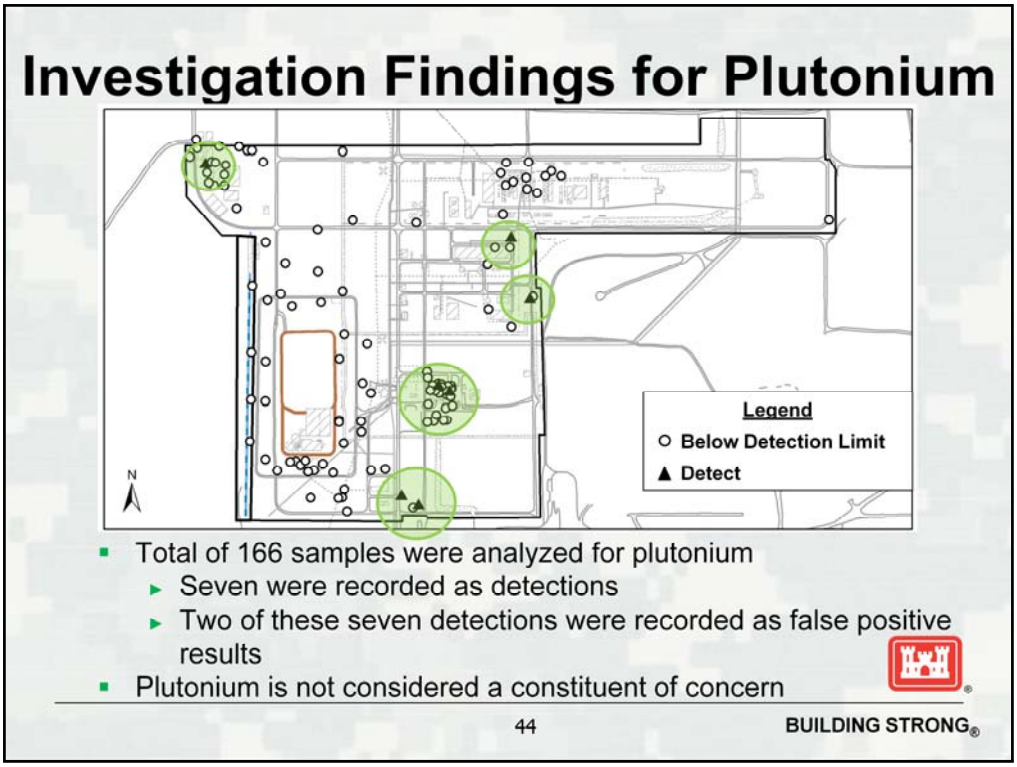
The RI Addendum includes plutonium results for an additional 107 samples of various environmental media collected to supplement the RI data. This provides a greater level of analysis for plutonium across the site. A review of plutonium results from this analysis follows.



SLIDE 43 – Speaker: Hallie Serazin, SAIC

As part of the investigation for plutonium and other fission products, the RI Addendum included:

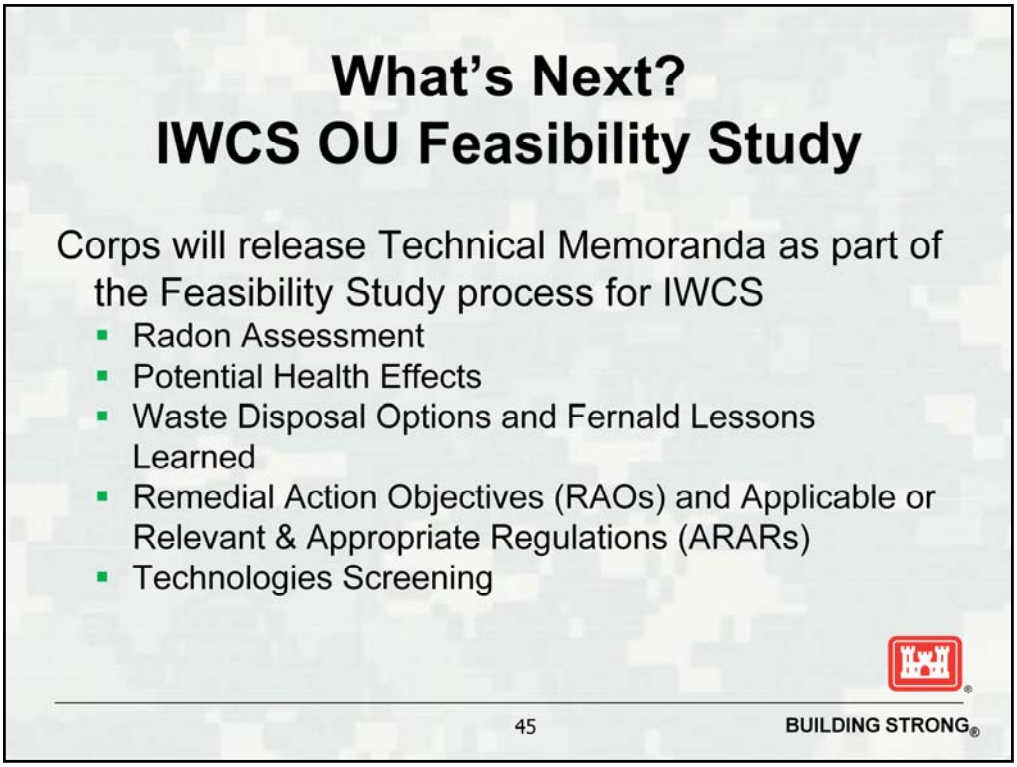
- A review of available historic records concerning radiological materials brought to the NFSS from the Knolls Atomic Power Laboratory and the University of Rochester
- Results for 17 samples collected during the RI that were later analyzed for plutonium and inadvertently left out of the report
- Plutonium results for 90 additional samples (50 samples of drummed soil borings left over from the RI, and 40 soil samples from the newly installed temporary well points)



SLIDE 44 – Speaker: Hallie Serazin, SAIC

In total, during the RI and RI Addendum field investigations, 166 samples of various environmental media were analyzed for plutonium. Plutonium was not detected in any of the 90 RI Addendum samples. Seven RI samples were reported as having detectable levels of plutonium. The locations of these detects are shown here. However, 2 of these samples showed uncertain results for plutonium and are not believed to be positive plutonium results. Two other samples also showed uncertain results but could not be fully discounted. These two samples came from subsurface soil and soil beneath a building slab. The 3 remaining samples were surface soil samples that contained plutonium at or near levels that would be expected to fallout from atmospheric testing of nuclear weapons and are unrelated to waste disposal at NFSS.

Whatever the source may be, plutonium concentrations observed at the NFSS did not exceed human health risk levels, so it poses no significant risk to humans. Based on the low number (5 of 166 samplesand concentration of plutonium detections, as well as the analytical uncertainties of the measurements at such low concentrations, plutonium is not believed to be a significant or widespread contaminant at the NFSS. Since the investigation for plutonium provided evidence that its presence on site is negligible, it can be considered a very low-risk radionuclide however, we will continue to analyze for plutonium as we progress into the Feasibility Study.



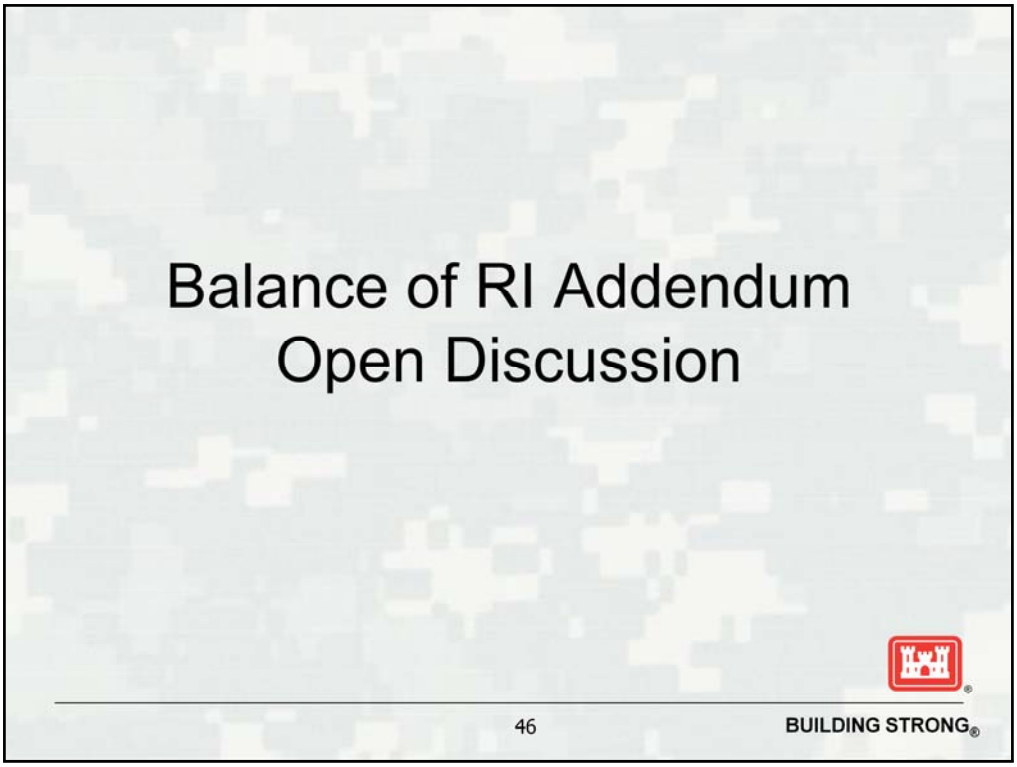
SLIDE 45 – Speaker: Hallie Serazin, SAIC

The RI Addendum is currently available.

In preparation for the IWCS Feasibility Study, the Corps released fact sheets describing the objectives of a series of Technical Memoranda. Public comments were received on the objectives in each Technical Memorandum. The comments are being considered in developing each Technical Memorandum. The public will again be provided the opportunity to comment on each Technical Memorandum.

Responses to public comments on each technical memorandum will be made available on the project website. Comments on the Technical Memoranda will also be considered in the development of the Feasibility Study for the IWCS.

Throughout the remedial process, the Corps will continue to maintain the website, will monitor the air, sediment, and water at the site, and will report the findings of the monitoring in the Environmental Surveillance Program annual report.



SLIDE 46 – Speaker: Hallie Serazin, SAIC

Open discussion of Balance of RI Addendum Topics

SLIDE 47 – Speaker: Hallie Serazin, SAIC

We now welcome you to view the posters, which present information from the RI and the RI Addendum reports. But first we would like to reiterate that the Corps values the community's input and welcomes your verbal comments. A transcript of tonight's meeting will be prepared and posted to the NFSS web site. You are also welcome to fill out comment cards which were distributed in tonight's meeting materials. Or, you can e-mail or write us at the address shown on this slide.

Thank you for your interest.