Number	Comments	Response
1	The Remedial Investigation Report (RIR) fails to determine whether the Interim Waste Containment Structure (IWCS) is leaking. Battelle reports contradict the United States Army Corps of Engineers (USACE) assertion that Building 409 has pre-existing contamination that accounts for very high detections in and around a nearby pipeline. The possibility that contamination may be associated with leakage from the IWCS is not explored. There are at least three possible pathways for leakage from the south dike to the two wells with elevated detects, SE of this wall, which have not been assessed. (These wells are also due east of Building 409.) a) Building 409 located outside of the IWCS had drains associated with it that could provide preferential pathways for uranium to migrate away from the IWCS (if the cell is leaking into Building 409.) There has been no sampling of these drains. b) Building 409 had a pipeline that ran to the Central drainage ditch that could provide preferential pathways for uranium to migrate away from the IWCS (if the cell is leaking into Building 409.) There has been no documentation showing this pipe was removed but this is not reflected on RIR maps. Two wells in close proximity to where this pipeline may be located show elevated detections.	Through the completion of three phases of the Remedial Investigation (RI) [including a geophysical survey of the Interim Waste Containment Structure (IWCS)] (RI Report (RIR), Appendix C, USACE 2007a) and regular monitoring of the IWCS as part of the ongoing Environmental Surveillance Program, the Corps concluded that the IWCS is intact and does not pose an immediate threat to human health and the environment near the NFSS. During the RI, non-intrusive means were used to assess the integrity of the IWCS in its current state in order to maintain the protectiveness of the cover and cutoff walls. Although former Building 409 drains could not be accessed for sampling, this area and the integrity of the dike around the IWCS were investigated and the RIR reports that that there is a strong potential that historic operations at former Building 409 are associated with the residual groundwater contamination present south of the IWCS (RIR, Section 5.10.1.4). Sufficient information is available to complete the Feasibility Study (FS) and the information that could be gained through intrusive sampling of the IWCS does not warrant the incremental costs and potential risk to workers or the environment. The geophysical survey of the IWCS completed during the RI indicated no short-term competency issues (RIR Appendix C). A supplemental assessment of the IWCS integrity, including a topographic survey to assess potential settling of the IWCS cap, will be included with the RIR Addendum (Section 5.2, USACE 2010). The current status of the IWCS is monitored on an ongoing basis as part of the Environmental Surveillance Program. A description of the Environmental Surveillance Program sampling conducted to demonstrate near-term cap integrity will be included in the RIR Addendum along with additional information regarding the IWCS contents (RIR Addendum, Section 5.0). Enhancements made to the Environmental Surveillance Program in 2008 are described in a fact sheet available at: (http://www.lrb.usace.army.mil/fusrap/nfss/index.htm#EnvSurv).

Number	Comments	Response
1 (cont.)	c) The clay installed to cover the sand beneath the south dike could have breached with the sand providing a pathway toward the two contaminated wells. The absence of wells between the south dike wall and the two contaminated wells precludes evidence that the cell is not leaking. The bottom of the IWCS cannot be assessed or reliably monitored. Comment Details: The RIR fails to determine whether the IWCS is leaking. The possibility that contamination may be associated with leakage from the IWCS is not explored. The use of indirect measurements and theoretical calculations do not provide the data necessary for evaluation of IWCS integrity. Where indirect measurements do suggest a potential problem, such as the detection of elevated levels of uranium immediately outside of the IWCS, the RI failed to investigate. The RI assumes the contamination is pre-existing despite contradictory statements from Battelle which follows these RIR excerpts: RIR Page 5-75, Paragraph 2. "Plumes of dissolved uranium were found around the northern section of the IWCS and in the area south-southeast of the IWCS [Exposure Units 7, 10 and 11]. These plumes are likely the result of site activities prior to the construction of the IWCS."	Former Building 409, whose foundation is currently located south of the IWCS, was a secondary water reservoir (i.e., Building 411 was the primary water reservoir) associated with the former Lake Ontario Ordnance Works (LOOW) fresh water treatment plant (RIR, Section 5.6.3). Treated slurry water from various bays in Building 411 was pumped to Building 409 for additional settling prior to being pumped to Ponds 3 and 4. Building 409 was also used for the storage of uranium scrap metals. In October 1985, after removal of a kind of uranium concentrate powder known as 'yellow cake', that had accumulated during use of Building 409 as an intermediate settling basin, the building underwent a decontamination operation to remove the most obvious contamination using a high pressure wash. Following decontamination, Building 409 was demolished and the rubble filled with fillcrete, and covered with backfill to a minimum depth of two feet. Operations conducted at former Building 409, as well as the gross decontamination method used prior to building demolition, may have contributed to the higher concentrations of radionuclides now evident in soil and groundwater in the vicinity of former Building 409. The Building 409 drains were not sampled by the Department of Energy prior to building demolition and they are now buried under building debris which makes sampling very difficult. However, the South Dike Piping Plan and Schedule indicates that pipelines leaving Building 409, towards the Central Drainage Ditch, were to be plugged or partially removed (RIR Addendum, Appendix 5-B). Also, there are several wells located in the vicinity of former Building 409 which are monitored as part of the Environmental Surveillance Program. Contamination from the IWCS has not been identified in the Central Drainage Ditch, or in the upper or lower water bearing zones.

Number	Comments	Response
1 (cont.)	RIR Page 5-75. Paragraph 4. "The Comprehensive Characterization and Hazard Assessment of the DOE-Niagara Falls Storage Site (Battelle 1981) reported contamination in the fire water reservoir, Building 409. Contamination inside the building was attributed to water seepage through the south wall from the earthen berm surrounding the reservoir. Low-level soil contamination south of Building 409 was listed as the probable source of building contamination. In addition, in 1985, as the K-65 residues were being transferred to Building 411 from the tower, Building 409 was used as a settling tank in the treatment of slurry water. According to unpublished construction reports, treated slurry water from various bays in Building 411 was pumped to Building 409 for additional settling prior to being pumped to Ponds 3 and 4. Building 409 underwent a gross decontamination operation using a high pressure wash in October 1985 after removal of the 'yellow cake' that had accumulated during its use as an intermediate settling basin. This information suggests that there is a strong potential for the residual groundwater contamination present south of the IWCS to be associated with these historical operations." Unpublished construction reports noted in the RIR (above) concerning the use of Building 409 as an intermediate settling basin were not provided in an appendix, and therefore, cannot be commented on. However, the RIR records Building 409 as having been decontaminated: RIR Page 1-12 Paragraph 2. "Remedial actions were also performed on Buildings 409 and 401. The superstructure, basement walls and floor slab of Building 409 were decontaminated after treated water that had been stored in the building was pumped to a surface impoundment."	Since the RIR was released, new information regarding the shape and extent of the groundwater plume in the vicinity of the former Building 409 (which is explained further below) has been reviewed and this information suggests that the configuration of this plume may over estimate actual groundwater contamination. The Building 409 plume shown in the RIR was drawn using dissolved total uranium data from monitoring wells, temporary well points and manhole locations. The linear plume extending north and east was drawn using uranium concentrations from one temporary well point (TWP833) and an existing manhole (MH06) on a sanitary pipeline. The plume was drawn assuming that groundwater was following a 10-inch potable water line which was left in place. For plume delineation, water in the manhole was assumed to be in direct contact with groundwater. In researching this plume, it was found that the concentration of dissolved total uranium at the temporary well point (TWP833) in the center of this plume had been misreported by the laboratory. The actual concentration was ten times lower than what was reported in the RIR. Also, the configuration of the plume is conservative because it was drawn assuming that pipeline water was in direct contact with groundwater, which does not appear to be the case. If we correct the misreported uranium value at the temporary well point, remove manhole data since it is not representative of groundwater, only include data measured in groundwater and include more recent Environmental Surveillance Program data, the configuration of the plume is different. The RIR Addendum will present a revised uranium groundwater plume map based on updated information (RIR Addendum, Section 4.5). There is currently no indication that contamination is moving out from the IWCS. Environmental Surveillance Program data do not indicate an increasing trend in uranium concentrations in groundwater wells near the IWCS that would be indicative of a breach. Instead, only seasonal fluctuation of uranium concentrations is noted, which is typical of other on-site wells near areas of past radioactive storage.

Number	Comments	Response
1 (cont.)	Battelle 1981, Page 4-13 described pre-existing contamination in Building 409 as minimal: "Several buildings have minimal contamination and could be reused with minor remedial actions or demolished. These include the fire water reservoir (Building 409), the surge tank (Building 415), and the most southerly accelerator (Building 412)." Battelle 1981, Page 4-11. Connecting Pipes and Drains. "Building 409 has connections both to the canal surrounding the surge tank, Building 415, and to the Central Drainage Ditch. However, no contamination was found in the drains of Building 409." Battelle 1981, Page 5-13 described contamination, south of Building 409 as "superficial": 'The area south of Building 409 was used for surface storage of crucibles, saw blades and other materials from metallurgical operations in the Niagara region. This area has residual, superficial contamination remaining (<0.75m), over a 334 sq. m (3600 sq. ft) area. During discussions with USACE staff about its belief that Building 409 has pre-existing contamination (even though the wells immediately outside this building were not elevated) they mentioned a theory that perhaps the Department of Energy (DOE) may have disposed of contaminated debris in Building 409 while constructing the IWCS - but since the purpose of the IWCS was to house contaminated debris and residues, this theory would seem unlikely.	It is understood that the IWCS is an interim storage structure. Its integrity was assessed during the RI and it is maintained and assessed on an ongoing basis by weekly inspections and biannual surveillance. Additional information regarding the IWCS integrity will be presented in the RIR Addendum (Section 5.0). Since the freshwater treatment plant, including Building 409 and 411, were constructed for the LOOW, construction records for the LOOW available from the LOOW Completion Report (White Engineering 1943) will be included as Appendix 12-B of the RIR Addendum. Cut-off wall excavation profiles from the Bechtel (1986) Geotechnical Post-Construction report were reviewed and compared to supplemental cross-sections created to verify the accuracy of the geostatistical analysis of sand lenses. These supplemental cross sections will be provided in the RIR Addendum (Section 12-10 and Appendix 12-J) along with construction reports for Building 409 (Appendix 12-B).

Number	Comments	Response
1 (cont.)	Also because the wells immediately outside Building 409 did reflect elevated detections, we have not yet seen evidence that the building itself is contaminated - this is why sampling the floor drains is recommended to identify one of three possible pathways of leakage from the south dike wall. USACE should furnish the construction reports used to explain the use of Building 409 as an intermediate settling basin for public review. Construction Problems: Published records relating to the construction of the IWCS show several problems were encountered in building the clay dike surrounding the IWCS. In particular, the brown sand and gravel unit was found to extend down to bedrock in one area of the southern dike. Bechtel Geotechnical Post-Construction Reports Volume 2. South Dike. September-November 1983: "One location along the southern section (E120 51672), a gray sand pocket was encountered near the top of the gray clay unit. As the sand was removed, the real extent of the sand pocket spread to include both walls of the excavation. The excavation was continued in that area until the underlying brown sand and gravel unit was reached. It was found that the brown sand and gravel unit extended down to bedrock. It was estimated that water was entering the excavation at a rate of 5 gallons per minute. After the bedrock was reached, the excavation was backfilled in an uncontrolled manner to the elevation of the surrounding trench area (elevation 299). The fill was placed in a rapid manner to avoid further undercutting of the side slopes due to the presence of running sand. Inspection indicated that the sand pocket was dipping downward in this area in all directions from the center of the trench. As a result of this dip toward the north (inside wall of the excavation) a thin layer of gray clay was exposed on the inside wall.	

Number	Comments	Response
1 (cont.)	It was also noted that large cracks had developed in both side slopes due to undercutting of the slopes. The base of the trench was not inspected due to the presence of standing water. It was again estimated that water was entering the excavation at a rate of 5 gallons per minute." Detection of high levels of dissolved uranium in and around underground pipes southeast of the southern dike warrant investigation, particularly since Building 409 located outside of the IWCS had drains associated with it that could provide preferential pathways for uranium to migrate away from the IWCS. Under these circumstances, existing groundwater wells situated in the area south of the IWCS would not necessarily detect migration of uranium away from the IWCS. As noted in the Summary section above, there are at least three possible pathways for leakage from the south wall to the two wells with elevated detections SE of this wall. These two wells are also due east of Building 409 and in close proximity to the detached pipeline with high uranium detections. To preclude leakage as an explanation for contamination of the SE wells USACE could consider: • Installation of wells along the south dike wall • Sampling of the drains of the former Building 409 and pipeline to the Central Drainage Ditch. The absence of any soil sampling in this area is also noted. In recent conversation USACE has mentioned it might disturb the IWCS to install wells on a slope outside the southern dike. However, several sets of wells have been installed on the IWCS perimeter slopes post-IWCS construction without any problems noted.	

Number	Comments	Response
2	The RIR deliberately excluded certain waste operations from its review of historical documents, such as the storage and disposal of Knolls Atomic Power Laboratories (KAPL) nuclear reprocessing waste. Comment Details: Review of historical documents for the RIR was incomplete. Also, the RIR excluded certain past site operations from its review of historic documents, such as the storage and disposal of KAPL nuclear reprocessing waste. The RI claims to have carried out a comprehensive review of historical documents. RIR Page xxxiv. E. S.3 RI Approach. "The RI began with a records review in order to gain an understanding of historic site operations and how these operations may have contributed to potential contamination." RIR Page 1-2. 1.3 RI Objectives and Scope. "Through a series of scopes of work (SOW) which governed the RI tasks and the Technical Project Planning (TPP) process which guided the program, the following items were identified as project objectives: Conduct an historical records search ..." RIR Page 2-2 Records Review. 2.2.2. Sources. "Four hundred forty-four documents and records were reviewed during the performance of this task. Most of the documents were prepared by the Department of Energy (or Department of Energy contractors) and its predecessor agencies. Documents authored by the U.S. Environmental Protection Agency, USACE and other governmental entities were also reviewed. The documents reviewed are listed and summarized in Appendix D.	The RIR did not exclude waste operations from its review and includes several references to KAPL waste. Additional available historic records regarding KAPL waste shipments will be presented in the RIR Addendum (Appendix 12-A). Additional information is limited, but it was not deliberately excluded from the RIR. Insufficiencies and lack of consistency within available historical records regarding KAPL materials cannot be remedied. Personnel at KAPL were contacted and they indicated that they had experienced a fire which resulted in the loss of many historical documents. However, all available KAPL records will be included in the RIR Addendum. Since cesium-137 was identified as a radionuclide of concern, it will be addressed in the FS. Plutonium and strontium-90 were detected on site, but at levels below that which would pose an unacceptable risk, even under the most conservative farming scenario. Therefore, plutonium and strontium-90 were not identified as radionuclides of concern. However, the presence of these constituents may affect acceptance of NFSS-generated waste at a potential disposal site (even though they may not pose an unacceptable environmental or human health risk), so they will continue to be evaluated during the project. Furthermore, since all of these radionuclides are associated with KAPL materials, they are very likely collocated on site. Therefore, any remedial measures taken based on the presence of cesium-137 would likely remedy other KAPL-associated radionuclides as well.

Number	Comments	Response
2 (cont.)	However, Appendix D contains no documents or records directly relating to KAPL waste. Only after numerous detections of cesium-137, a fission product associated with KAPL waste, were found throughout the NFSS was a review of KAPL documentation considered, four years after the initial records review. No search for historical KAPL records was carried out. Field Sampling Plan Addendum for the Disposal of Abandoned Drums and Collection of Additional Surface and Subsurface Soil Samples, RIR NFSS, July 2003. Page 1, paragraph 2: "The activities described in this document are based on the December 2002 Statement of Work. The objectives for this task are to: - Further characterize contamination in the surface and subsurface soils in the Exposure Units at the NFSS and the Niagara Mohawk Property; - Sample and dispose of abandoned drums found at the NFSS and Vicinity Property G and characterize the surface and subsurface soil in the vicinity of the drums; - Manage and dispose of investigation derived waste generated during this task. Review available documentation on the KAPL wastes, gamma spectroscopy results and soil and groundwater RI results to determine if re-analyses of surface soils collected previously should be carried out or if additional samples should be collected. (The re-analysis of samples and the collection of additional samples as a result of this review have been postponed to a later task.) "	

Number	Comments	Response
2 (cont.)	- Review available documentation on the KAPL wastes, gamma spectroscopy results and soil and groundwater RI results to determine if re-analyses of surface soils collected previously should be carried out or if additional samples should be collected. (The re-analysis of samples and the collection of additional samples as a result of this review have been postponed to a later task.) " The "available documentation" refers to a 2005 summary memo prepared by KAPL management regarding the 1950's KAPL waste shipments to and from the LOOW site. However, this 2005 summary contained a number of inconsistencies and failed to show that all KAPL waste actually left the LOOW site (for Oak Ridge.) It also did not address the issue of total radioactivity contained in the waste shipments. The failure of the RIR to review all relevant KAPL documents understates the potential KAPL volumes and impact at the site.	

Number	Comments	Response
3	Background samples were located in areas impacted by Department of Defense (DOD) and Department of Energy activities at the LOOW. Comment Details: Background groundwater samples on Modern landfill are not valid. The RIR erroneously assumed background samples were taken in areas not impacted by DOE and or DOD activity, RIR. Page 3-12 3.8.1.2. Background Samples. "Background soil samples collected by EA for chemical analysis during the LOOW RI were also used for this RI. Tetra Tech collected additional background samples for radiological analysis. Background sampling locations were located in the buffer area of the former LOOW. These areas were considered to be representative background sampling locations since they are close to Niagara Falls Storage Site (NFSS) and are presumably un-impacted by LOOW or NFSS site-related activities." RIR Page 2-2. Paragraph 1. "Wells on the adjacent Modern Landfill site were selected for background groundwater sampling. All of the Modern Landfill wells that were designated as background wells are upgradient of the Modern Landfill disposal cell." Background from Modern is not valid because: -The Modern Landfill is adjacent to the NFSS, on the Developed part of the LOOW used for DOE and DOD activities.	Background groundwater samples were collected at locations along the boundary of the LOOW site and on Modern Landfill property (12 wells in the upper water-bearing zone and 18 in the lower water-bearing zone) (RIR, Section 2.1). The Modern Landfill site was selected to establish background levels because the wells there are hydraulically upgradient (located up slope) of the NFSS and within one mile of the site (assuring similar lithology). Since Modern Landfill is hydraulically upgradient from the NFSS, wells located here are upstream from the facility and allow sampling and analysis of groundwater before it has reached the site related contamination. There are also a sufficient number of available wells completed in the water-bearing zones of interest. Additionally, well construction and geology were documented for the Modern Landfill site. The feasibility of using other wells located further upgradient from Modern was investigated; however, construction and geologic information for the other wells could not be located so these wells were not suitable background wells. The collection of background data was planned with input from many. The New York State Department of Environmental Conservation (NYSDEC) reviewed the initial Statement of Work and determined that the Modern Landfill site was a suitable location for the collection of background groundwater samples. The Field Sampling Plan Addendum was reviewed by the New York Department of Health , as well as the Buffalo Corps, SAIC, Modern Landfill representatives, and the Tetra Tech Independent Technical Review Team also reviewed the Field Sampling Plan Addendum to insure that the samples would be representative of the background conditions in the vicinity of the NFSS. All review comments were resolved prior to the collection of the background groundwater samples and the reviewers agreed that Modern Landfill was an acceptable location for the collection of

Number	Comments	Response
3 (cont.)	-The Modern Landfill is down-gradient of the former Lewiston Landfill, where chemical contamination has previously been identified. Background samples used in the RIR for surface water and sediment were taken at the perimeter of the NFSS, despite the prior history of contamination of the NFSS vicinity properties for both DOD and DOE contamination	background groundwater samples. In addition to numerous studies of the NFSS completed by the Department of Energy, the RIR cited two Modern Landfill studies: • Wehran Engineering 1979. *Engineering Report of the Modern Landfill, Inc. Sanitary Landfill.* Prepared for Modern Landfill, Inc., August 1979 • Wehran Engineering 1990. *Supplemental Hydrogeologic Investigation for Modern Landfill, Inc.* Report and Plans prepared for Modern Landfill, Inc., April 1990 Little documentation showing prior impacts to the Modern Landfill property due to Department of Defense or Department of Energy operations was found. A review of archival aerial photos was completed as part of the historic site assessment and is included in the site history section of the RIR (Section 1.5). Historic aerial photos were used to locate former operational areas. Section 6.0 of the RIR Addendum will include a re-examination and justification of the NFSS groundwater background data set, along with a historical survey report based on aerial photos generated by the Corps' Topographic Engineering Center (Appendix 12-C). Background samples used in the RIR for surface water and sediment were taken at the perimeter of the NFSS in areas where available historical information did not indicate an impact by Manhattan Engineer District/Atomic Energy Commission operations (RIR, Section 3.8 and 3.9). Limited suitable areas for surface water and sediment sampling exist near the site.

Number	Comments	Response
3 (cont.)		To further obtain a representative background data set, a statistical outlier test was conducted to test for uniformity in the data set for all background media including groundwater, surface soil, subsurface soil, sediment and surface water. An outlier is an observation that does not follow the pattern established by other observations. Groundwater data from two background wells located near a rail bed on the Modern Landfill property (PZ-21S and PZ-25S) were determined to contain outlier concentrations of uranium and uranium isotope ratios indicative of man-made contamination. Therefore, all data from these two wells were removed from the background data set.

Number	Comments	Response
4	The RIR Groundwater Fate and Transport Model fails to account for the impact of the abandoned underground utility lines on movement in the upper water-bearing zone, although it concludes these pipelines provide potential pathways for migration across the site. Sand lenses are not addressed. Comment Details: The RI Model for Groundwater Fate and Transport fails to account for the impact of the abandoned underground utility lines on movement in the upper water-bearing zone, although it concludes these pipelines provide potential pathways for migration across the site. Sand lenses are not addressed. RIR Page xiv Paragraph 2. "it is possible that the pipelines/subsurface utilities and surrounding gravel provide a pathway for site-related constituents to travel between Exposure Units and may explain the existence of constituents in many of the areas. Also, many manholes are damaged and allow surface water to enter the sewer system. Finally, given the age and generally poor repair of the system, infiltration and exfiltration are likely occurring." RIR Page xlvii Paragraph 2 "Uranium isotopes are predicted to migrate offsite within 1,000 years at concentrations that exceed the screening levels in Exposure Units 1 and 11." The theoretical times calculated for contaminant migration off site are not accurate and should be recalculated using an adjusted Groundwater Fate and Transport Model. The model should also be reviewed with respect to the assumption that sand lenses are laterally discontinuous and therefore do not effect migration times. Where sands lenses are not continuous they still impact timelines.	The Groundwater Model (USACE 2007c) is a regional model that is focused primarily on predicting long-term contaminant transport beyond the boundaries of the NFSS (Groundwater Model, Section 1.3). It is not designed to predict short-distance transport between Exposure Units, since the ongoing Environmental Surveillance Program already fulfills this need by detecting any potential contaminant movement long before contaminants could reach the property boundary. The underground utility lines noted in the comment have been cut, capped, removed, or grouted in place. Additionally, the LOOW Underground Utilities Remedial Investigation concluded that a majority of the former LOOW pipelines and all of the pipelines leaving the NFSS did not have bedding material. The pipelines are surrounded by clay with extremely low permeability that inhibits contaminant transport. The modeling report does not lead to the conclusion that pipelines provide potential preferential pathways for groundwater flow. The source term input into the model conservatively accounts for contaminated water within the pipelines, which is a decision that will be reassessed in the RIR Addendum (Section 4.0). During RI sampling efforts, 26% of the pipelines that reside below the groundwater table were dry; indicating that unimpeded connection with groundwater may not be prevalent. Additionally the LOOW Underground Utilities Remedial Investigation showed that lines leaving the NFSS (sanitary sewer and acid waste lines) were encased in concrete. A summary of pipeline samples collected and analyses performed is provided in RIR Table 3-20. The omission of sand lenses as discrete flow components does not invalidate the model since the long-term (long-distance) transport characteristics of the upper water-bearing zone will be governed by the lacustrine-derived brown clay till (as bulk ground mass) that is commonly found as depositional sheets throughout Niagara County (Groundwater Model, Section 4.4). The presence of isolated higher permeability sand lenses within the till simply increases the "bulk" hydraulic conductivity of the till. The hydraulic conductivity was accounted for using statistics to assign zones of modeled permeability in the upper water-bearing zone.

Number	Comments	Response
5	The radiological groundwater plumes identified in the RI, end at the western NFSS fence line because there was no sampling beyond the fence line and insufficient sampling at the boundary. Groundwater contamination would appear to already extend further west onto the Niagara Mohawk property. Comment Details: Radiological plumes end at the western NFSS fence line because there was no sampling beyond the fence line. Groundwater contamination would appear to already extend further west onto the Niagara Mohawk property. The RIR delineates groundwater plumes surrounding the IWCS as ending at the site boundaries, but a review of the total uranium results for surface water in the West Drainage Ditch on Niagara Mohawk property shows close correlation with the total uranium groundwater plumes to the west of the IWCS; i.e., the levels of total uranium in surface water in the West Drainage Ditch increase and decrease as the ditch is followed north, according to the increase and decrease in total uranium in groundwater on the adjacent NFSS. See color map below; surface water results for total dissolved uranium are inserted at left. No groundwater samples were taken on the Niagara Mohawk property (a right of entry was in place.) Groundwater samples should be taken between the NFSS fence line and the West Drainage Ditch on Niagara Mohawk property in order to further delineate groundwater plumes.	The Corps concurs that additional samples along the western boundary of the NFSS are needed. To address uncertainty associated with the uranium plume west of the IWCS, three new surface water and sediment locations in the West Drainage Ditch (Exposure Unit 9) were added to the Environmental Surveillance Program in October 2008. The results from these new surface water and sediment locations in the West Drainage Ditch will be reported in an Addendum to the RIR (Section 9.2.5). Although there appears to be some correlation between the levels of total uranium in surface water and groundwater west of the IWCS, several lines of evidence were examined that suggest otherwise including the pattern of uranium distribution in surface water and groundwater and the possibility of other potential uranium sources. **Pattern of Uranium Distribution** • The concentrations of total uranium measured in West Drainage Ditch surface water are variable along the ditch. Surface water concentrations range from 12.3 µg/L to 48.3 µg/L with no obvious concentration gradient. This suggests that the uranium could have come from multiple sources rather than a single source with gradually decreasing concentrations moving away from a groundwater seep or some other discreet source. • The outer extent of the groundwater contamination along the west side of the IWCS was well characterized and delineated using densely spaced sampling points (both permanent and temporary). The concentrations of dissolved total uranium and total uranium (as well as isotopic uranium) detected in wells and temporary well points between the IWCS and the West Drainage Ditch correspond to low background levels. These background-level uranium concentrations strongly suggest that the source of uranium contamination in the West Ditch is not groundwater seepage.

Number	Comments	Response
5 (cont.)		• The potential for the West Drainage Ditch to receive groundwater influx at the rate needed to get the concentrations observed in surface water is inconsistent with the relative low mobility of uranium and low soil permeability observed at the NFSS. • The observed pattern of contaminant distribution does not support the suggestion of groundwater transport to West Drainage Ditch surface water but is more indicative of historical soil erosion and turbid overland flow that entered the West Drainage Ditch from freshly cleared areas of the site during RI mobilization. **Other Potential Uranium Sources** • The radioactive R-10 storage pile was left uncovered and unprotected in this area for a number of years. Wind erosion and surface water runoff likely contributed to the contaminant migration to the west. The R-10 pile is now contained within the IWCS. • Since the RI was completed, consistently decreasing concentrations of uranium in the West Drainage Ditch surface water have been observed. By comparison, in the Central Drainage Ditch, which has been monitored over a longer time frame, the concentration of total uranium peaked in 2004, which is also the year that site clearing was done in preparation for RI field investigations. The mobility of uranium in surface runoff may have been enhanced by ground disturbing activities preceding RI field operations and low pH, or acid rainfall. While the RI was being conducted the pH of rainfall varied between 4.3 and 4.8 (NYSDEC data), which is low enough to increase the mobility of uranium from overland flow from disturbed soil. Additional investigation of the total uranium groundwater plume located west of the IWCS was conducted in late 2009 as part of the RIR Addendum, including areas on the National Grid property (RIR Addendum, Section 4.5).

Number	Comments	Response
5 (cont.)		The objective of this investigation was to define the off-site extent of the total/dissolved uranium plume in groundwater west of the IWCS and east of the West Drainage Ditch, and to determine the potential for interaction from groundwater to surface water in the West Drainage Ditch.
6	Data for total uranium in surface water in the West Ditch suggests this ditch is receiving groundwater from the UWBZ. Comment Details: There appears to be close correlation between the levels of total uranium in surface water at different sampling points along the ditch and the total uranium upper level groundwater plumes on the adjacent NFSS. USACE noted the phenomenon of discharge of the upper level groundwater to the Central Drainage Ditch but not to the West Ditch. The ability of the upper groundwater to become surface water, whenever the water table is above the level of the bottom of the ditches on the NFSS provides an important additional migration path and should be incorporated into the fate and transport model for the NFSS.	Although there appears to be some correlation between the levels of total uranium in surface water and groundwater west of the IWCS, several lines of evidence were examined that suggest otherwise, including the pattern of uranium distribution in surface water and groundwater and the possibility of other potential uranium sources (RIR Addendum, Section 9.2.5) . Additional investigation of the total uranium groundwater plume located west of the IWCS was conducted in late 2009 as part of the RIR Addendum, including areas on the National Grid property (RIR Addendum, Section 3.2.3). The objective of this investigation is to define the off-site extent of the total/dissolved uranium plume in groundwater west of the IWCS and east of the West Drainage Ditch, and to determine the potential for interaction from groundwater to surface water in the West Drainage Ditch. The results of this investigation will be presented in the RIR Addendum (RIR Addendum, Section 4.5).

Number	Comments	Response
7	The potential for other fission products and transuranic materials to be present on the NFSS has not been adequately investigated and is a significant data gap in the RIR. Five KAPL waste streams were excluded from investigation. Comment Details: The RIR identifies Cs-137 as a ROC on the NFSS, but does not appear to acknowledge the known storage of fission-product contaminated materials on site. RIR Page 5-64- 5.9.1 Transuranic and Fission Product Data Review "A review of almost 950 surface soil, subsurface soil and sediment samples was conducted to identify fission product cesium-137 and the neutron activation product cobalt-60. Both of these radionuclides are produced in nuclear reactors and are commonly present in radioactive wastes. Cesium-137 is also a common radionuclide present in fallout from aboveground nuclear weapons tests. The existence of either of these radionuclides could be an indication that fission-product contaminated materials were stored at NFSS." The KAPL in Schenectady sent six different types of nuclear reprocessing waste to the site during the 1950s. - only one of these waste streams has been considered, and only as an afterthought in the RIR.	The Corps agrees. Further investigation of available historic records regarding potential KAPL waste and the occurrence of transuranics was conducted and will be documented in the RIR Addendum (Appendix 12-A and Section 11.0). Officials at KAPL informed the Buffalo District Corps that many records were lost due to an extensive fire at their facility. To characterize areas potentially impacted with KAPL material, the RI included biased sampling for plutonium that was conducted where elevated levels of cesium-137 had been detected. This means that based on the knowledge that KAPL waste may have contained both cesium-137 and plutonium; locations with elevated cesium-137 were also analyzed for plutonium. The RIR also states that the unexpected, rare occurrences of elevated cesium-137, strontium-90, plutonium-239/240 and enriched uranium will be included in the FS evaluation and in remedial design efforts. Cesium-137 was identified as a radionuclide of concern, so it will be addressed in the FS. Plutonium and strontium-90 were detected on site, but at levels below those which would pose an unacceptable risk, even under the most conservative resident farming scenario. A re-evaluation of plutonium 239/240 was completed as part of the RIR Addendum (Section 11.0). Based on the low number and concentration of detections, as well as the analytical uncertainties of these findings, plutonium-239/240 data is not believed to warrant additional investigation at the NFSS.

Number	Comments	Response
8	The RIR omitted previously reported radium-226 sample data registering 856,000 pCi/g. Comment Details: RIR Page 5-55, paragraph 1 "The radium-226 concentration in sample SS203-003, collected approximately 80 feet south of Building 401 in Exposure Unit 13, was 1,140 pCi/g - the highest radium-226 concentration measured at the NFSS. The gamma radiation at this location measured 200,000 counts per minute. This sample consisted of a single nugget, which accounted for almost the entirety of the gamma radiation measured at this location." The maximum detection for radium-226 in surface soil on the NFSS was 856,000 pCi/g at the June 2003 TPP Meeting.	The radium-226 sample registering 856,000 pCi/g was the 'hot rock' or 'nugget' found at SS203-003 (RIR, Section 5.7.1.1). The nugget was removed from the soil sample and the remaining sample contained 1,140 pCi/g of radium-226. The nugget was omitted from the RI data set and not further discussed in the RIR text because it was removed from the site when it was discovered. This rock was not representative of adjacent soils and was effectively removed through sampling. The site-wide gamma walkover survey was used to locate gamma-emitting radionuclides such as those found in the hot rock.

Number	Comments	Response
9	The RIR fails to establish background values for all relevant media and excludes data (ex. plutonium-239) on this basis. The exclusion of positive detections of contaminants in this way leads to false conclusions about contamination on site. Comment Details: A core sample from Building 401 was analyzed and found to contain 5.7 pCi/g of plutonium-239. The RIR does not include this detection of plutonium-239 in its site-wide evaluation of transuranic and fission product data. RIR Page 55-66 "The conclusion based on available data is that americium-241, which has not been identified as a radionuclide of concern in the Baseline Risk Assessment, is not a contaminant, thus, it is unlikely that other transuranics are present in significant concentrations or are widespread in NFSS soils/ sediment. This is further supported by a review of transuranic detections at the site. For example, there were only three very low detections of plutonium 239/240 in soil out of 34 samples analyzed. These detections occurred in Exposure Units 8, 11 and at concentrations of 0.322, 0.129 and 0.536 pCi/g, respectively." The RIR excludes this plutonium-239 detection because no RI background level was established: RIR Page 4-2. Section 4.3.1.2."Because no suitable background data sets for the cores or railroad ballast media were available, it was not possible to determine if any parameter in these samples exceeded background. For this reason, site-related constituents were not determined for these media."	Samples of railroad ballast, building materials and road cores were collected and analyzed during the RI. A data summary for railroad ballast and building and road core samples is provided in Table 4.2 of the RIR. The results were not evaluated in the RIR or the Baseline Risk Assessment because there was no representative background level for comparison and also because exposure to these media are not typically evaluated in a CERCLA risk assessment, which focuses on exposure to environmental media. The building is not occupied and is slated for demolition. Current and future exposures to any contamination in the building materials are limited to construction workers who will be working under a radiation projection plan; therefore, including these data in the CERCLA Baseline Risk Assessment serves no purpose for the FUSRAP project. Background levels for building cores, roadways and railroad ballast were not established because these features do not occur in natural areas, so there are no naturally-occurring background levels for these media. However, to be thorough in establishing nature and extent of contamination on the site, these samples will be screened against surface soil background levels and risk-based limits in the RIR Addendum (Section 8.0).

Number	Comments	Response
10	The RIR reports on the discovery of several abandoned drums on the NFSS and the neighboring Vicinity Property G. One of the two drums on the NFSS contained radioactive process material. Comment Details: The RIR reports on the discovery of several abandoned drums on the NFSS and the neighboring Vicinity Property G. One of the two drums on the NFSS contained americium, likely to be associated with KAPL waste. (Vicinity Property G drums were too deteriorated to sample.) The discovery of drums, despite prior DOE ground penetrating radar surveys, shows that ground penetrating radar can not be relied upon to detect buried drums in the NFSS clay soils. The RIR analyzed the drum contents and found one drum contained Uranium residues along with Americium-241. Since Americium-241 would not be present in a natural uranium product, is the source of this material KAPL?	The abandoned drums referred to in the RIR were not buried, but were found on the ground surface; therefore, ground penetrating radar was not necessary in this instance (RIR, Section 7.3.2). The source of the abandoned drums is not known, but given that one drum contains americium, it could be associated with KAPL waste. Drum removal activities on the Vicinity Property G were performed in July 2003 (Tetra Tech 2009). During this effort nine drums from three locations were characterized, containerized and removed from the Vicinity Property G. During drum removal some of the surrounding soil was also containerized. These drums were moved to Building 401 on the NFSS and await disposal at an appropriate facility.

Number	Comments	Response
11	The Phase 2 RIR reported that gamma surveys failed to detect elevated levels of uranium and radium. The contractor cited reverse correlations in comparing gamma survey work to soil sample results. Comment Details: The Phase 2 RI indicates gamma surveys could fail to detect elevated levels of uranium and radium. The report cites reverse correlations in comparing gamma survey work to actual soil sample results. Does this change Data Quality Objectives for the sampling in the RI? i.e., could areas requiring remediation be materially understated? Field Sampling Plan Addendum Revision 1, Phase 11 R1 at the NFSS, page 5. 2.3 Gamma Walkover Surveys and Resulting Phase 11 Data Needs. "During Phase 1, gamma walkover surveys were used to screen the areas surrounding each planned surface soil and sediment sample collection location to identify local "hotspots" where samples were collected. The edges of ditches and nearby areas were similarly screened prior to collection of each sediment sample. Gamma readings ranged from 7,000 counts per minute to 126,000 counts per minute. There does not appear to be a good correlation between the walkover survey results and the results of radiological analysis of corresponding samples.	Gamma walkover surveys were used at the NFSS because they provide good coverage of surface soils (RIR, Section 3.5). The results of the gamma walkover survey were used to guide subsequent soil, road/pad coring, sediment, and groundwater sampling efforts. Scan data in counts per minute may not always be correlated to pCi/g values, especially when there is a mixture of contaminants. A mixture of radionuclides is expected at the NFSS and some radionuclides (e.g.thorium-230) cannot be identified through field gamma measurements without a proven surrogate (which is a marker compound whose measurement correlates closely with the compound of interest). Walkover surveys were used at the NFSS because they are economical and provide good coverage of surface soils. Results of the gamma walkover survey were used to guide subsequent soil, road/pad coring, sediment, and groundwater sampling efforts. Historical operations data also were used to guide sampling efforts.

Number	Comments	Response
11 (cont.)	The correlation fails in two ways. The first failure is that a single reading from the gamma walkover survey exhibits multiple concentrations from an individual constituent, some of which exceed the screening value. As an example, for the 11,000 counts per minute gamma survey reading, radium226 concentrations ranged from 0.734 pCi/g to 9.49 pCi/g. Some of these concentrations are above the 2.7 pCi/g screening value. The second failure is that some gamma walkover values exhibit a reverse correlation (i.e., at 9,000 counts per minute uranium-238 has a value of 120 pCi/g and at 126,000 counts per minute the uranium-238 value is 1.8 pCi/g). This is probably due to the alpha particle disintegration of some of the isotopes (i.e. uranium-238) instead of gamma ray emissions. In a walkover survey, detection of alpha particles would be reduced by shielding effects (e.g., distance, soil water and vegetation), whereas the gamma radiation penetrates the ground cover and would be more readily detected."	

Number	Comments	Response
12	The RIR confirms the results of the IWCS Environmental Surveillance Program, carried out over a twenty year period that dissolved uranium in the upper water-bearing zone is highly mobile. The groundwater modeling used for the RI fails to address the chemistry of the upper and lower water-bearing zones and the impact this has on contaminant solubility, notably radium, thorium and uranium. The use of dissolved uranium in the upper groundwater should be evaluated as an indicator of radium and thorium subsurface contamination. Comment Details: Several groundwater plumes of dissolved uranium have been identified on the NFSS. However, the RI fails to consider the geochemical issues of solubility of radionuclides in the upper and lower water-bearing zones, in the context of the upper groundwater being a dilute sodium/calcium/magnesium sulfate solution, while the lower groundwater is much more concentrated in sodium chloride/sulfate. The effect of groundwater chemistry on solubility and migration should be reviewed for uranium, radium and thorium and the findings incorporated in the RIR groundwater fate and transport model. Since uranium is present along with radium and thorium in the NFSS residues, elevated uranium in the UWBZ should be evaluated as a useful indicator of subsurface radium and thorium contamination. RIR Page 5-75 "Plumes of dissolved uranium were found around the northern section of the IWCS and in the area south south-southeast of the IWCS (Exposure Units 7, 10 and 11).	The NFSS Groundwater Flow and Contaminant Transport model employed a multi-step approach to simulate source releases and unsaturated zone transport within the IWCS and elsewhere at the NFSS (Groundwater Model, Section 4.0). This approach utilized separate modeling codes to estimate the water flux through the IWCS; and predict vertical transport of contaminants through the unsaturated zone. The model predicts that uranium-238, uranium-234, uranium-235, *cis*-1, 2-dichloroethene, and vinyl chloride will exceed their respective screening levels within the NFSS property after 1,000 years. The model also predicts that uranium-238 and uranium-235 will exceed their screening level at the NFSS property boundary after 1,000 years. NFSS-specific groundwater chemistry was taken into consideration by the *Geochemical Equilibria in Water Model*, known as MINTEQ modeling, that was performed as part of the geochemistry analysis (Groundwater Model, Section 3.0 and 4.4.3.5). An in-depth description of the geochemical analysis is presented in Appendix D of the *Groundwater Flow and Contaminant Transport Modeling* Report. In addition, the MINTEQ-estimated solubility of IWCS-related COCs were accounted for in the IWCS leaching model, which used a solubility limited contaminant release function to ensure proper recalcitrance of the source terms and associated geochemical release. A distribution coefficient, or K_d, is the ratio of the concentration of a substance in the aqueous or liquid phase, to the concentration bound to soil or in the solid phase. The K_d is used to model the mobility of a substance in groundwater. Initially, the K_d value for uranium, which is more easily transported in groundwater than other radionuclides of concern, was conservatively estimated to be low (3.6 L/kg) compared to available literature values (Groundwater Model, Section 4.3.2.1). The analysis of a collocated soil and groundwater sample was used to better bracket the site soil K_d values in the upper water-bearing zone. This analysis showed the K_d values for the upper water-bearing zone brown clay till are higher than initially used in the RI model, geometrically averaging about 122 L/kg rather than the initial 3.6 L/kg value from the limited literature used to develop that value.

Number	Comments	Response
12 (cont.)	These plumes are likely the result of site activities prior to the construction of the IWCS. The issue of radium and uranium sorption in the clay soils of the NFSS has been investigated in the past and a number of conclusions drawn, but thorium does not appear to have been evaluated. Geochemical Information for Sites Contaminated with Low Level Radioactive Wastes: I - Niagara Falls Storage Site, F. G. Seeley and A. D. Kelmers. Oak Ridge, 1984.Abstract Page 9 Paragraph 4, Page 2 Paragraphs 9 & 2. "Poor uranium sorption was exhibited by all soil/groundwater systems; maximum sorption ratios ranged from 3.9 to 9.0 L/kg at the lowest uranium solution concentrations tested and decreased to 1 L/kg at higher concentrations. One sample of soil at the 13.7m (45 ft) depth (just above bedrock) showed high uranium sorption. Uranium was very soluble in soil/groundwater systems; the apparent concentration limit was greater than 6 g/L. The high solubility was shown to be due to the formation of the soluble uranyl tricarbonate anionic complex. Very high radium sorption ratios (up to 11,200 L/kg) were obtained." "The results suggest that any uranium which is in solution in the groundwater at the NFSS may be poorly retarded due to the low uranium sorption ratio values and high solubility measured. Further, appreciable concentrations of uranium in groundwater could be attained from soluble wastes. Release of uranium via migration could be a significant release pathway. Solubilized radium would be expected to be effectively retarded by soil at the NFSS as a result of the very high radium sorption ratios observed."	The initial K_d of 3.6 L/kg used in the groundwater model was derived from site-specific studies. The K_d value used to assess uranium in groundwater will be reassessed during development of the FS. A distribution of thorium in the upper water-bearing zone groundwater was evaluated in the RIR. Figure 5-7 shows dissolved plumes of thorium-230 in the upper water-bearing

Number	Comments	Response
13a	Historically, background concentrations of total uranium in the upper groundwater at the LOOW site were measured off site and found to be consistently less than 3 pCi/L. (NFSS Environmental Surveillance Reports 1982-1986.) The offsite groundwater sampling locations were two residential wells north of the LOOW site, as shown in Fig 3-3, Appendix A1, (NFSS Environmental Surveillance Report, 1986.) Table 3-8, Appendix A1, "Annual Average Concentrations of Uranium in NFSS Water Samples, 1982-1986", shows on site groundwater monitoring results also support the 3pCi/l background value as being correct – several on site wells show concentrations of total uranium below 3pCi/L.	Historically the background concentrations of uranium in the upper water-bearing zone at the LOOW vicinity has not consistently been less than 3 pCi/L, even though this conclusion can be reached using the information given in Table 3-8 of the 1986 Environmental Surveillance Technical Memorandum documenting the findings of the Environmental Surveillance Program as noted in this comment. The Department of Energy originally used 3 offsite background locations (identified as locations 17, 18 and 19), and later only used 2 (locations 17 and 19). It is not known why location 18 was dropped in 1986, nor why these values were not included in the compilation referred to in this comment in the 1986 Environmental Surveillance Technical Memorandum. Also, the Department of Energy used a conversion factor of 0.667 pCi/µg to convert uranium concentrations given in mass to the corresponding concentration in activity. We are currently using a conversion factor of 0.9 pCi/µg based on more recent information for drinking water supplies developed by the U.S. Environmental Protection Agency. If we use all of the information reported in the individual Environmental Surveillance Technical Memorandums for the three original background locations and use a consistent conversion factor of 0.9 pCi/µg to convert from mass to activity (for the 1982 and 1983 Environmental Surveillance Technical Memorandums) and adjust the values for the 1984 through 1986 Environmental Surveillance Technical Memorandums (which were calculated using a conversion factor of 0.667 pCi/µg), we obtain the following information. **Location** / **Uranium Concentration (pCi/L)** **1982** / **1983** / **1984** / **1985** / **1986** **17**: 11.7 / <4.5 / 4.1 / 4.1 / <4.1 **18**: <4.5 / 9 / 9.5 / 4.1 / - **19**: <4.5 / <4.5 / - / 4.1 / <4.1 Based solely on this more complete and consistent compilation, it is seen that there is a wide variation in the results reported for the 3 background wells.

The table within the response above:

Location	Uranium Concentration (pCi/L)				
	1982	1983	1984	1985	1986
17	11.7	<4.5	4.1	4.1	<4.1
18	<4.5	9	9.5	4.1	-
19	<4.5	<4.5	-	4.1	<4.1

Number	Comments	Response
13a (cont.)		However, it is clear that the compilation given in Table 3-8, as cited in this comment, over-simplifies the results. It does not include location 18 and is based on a conversion factor that is lower than what is currently being used to convert uranium mass to activity. The onsite background wells that have uranium concentrations below 3 pCi/L in the 1986 ESTM are generally in the lower water bearing zone (the wells are designated as "BH"). For the RI, several upgradient wells were sampled to establish a background level of naturally occurring constituents in groundwater, as opposed to the single upgradient well used in the Environmental Surveillance Technical Memorandum. For the NFSS background, wells were located in both the upper and lower water-bearing zones. The naturally occurring concentrations of uranium and other metals and ions may vary among groundwater zones. The background groundwater from the upper water-bearing zone averages 5.61 pCi/L for dissolved uranium-234 and 4.09 pCi/L for dissolved uranium-238 (with an average isotopic ratio of 1.38); this omits outlier data from piezometer-21S and piezometer-25S. The corresponding lower water-bearing zone data average is 2.12 pCi/L for dissolved uranium-234 and 1.23 pCi/L for dissolved uranium-238, with an isotopic ratio of 1.92. The summed averages (uranium-234 + uranium-235 + uranium-238) approximate 10.08 pCi/L and 3.52 pCi/L, respectively. Using the 0.9 conversion factor gives respective total uranium values of 11.2 µg/L and 3.9 µg/L, which are coincident with upper water-bearing zone well B02W20S data and modified Department of Energy results shown above. The current background dataset is therefore applied correctly and represents the range of natural conditions.

Number	Comments	Response
13b	The “background” concentration of total uranium in the upper groundwater at the LOOW site was artificially increased when the NFSS Environmental Surveillance Program was altered and background samples were no longer measured at off site locations. In 1987, sampling of domestic water supply wells was terminated after first quarter results were obtained, since the concentrations of uranium and radium had not exceeded 3.0 pCi/L and 0.3 pCi/L respectively, since 1983. Table 3-3, Appendix A2, (NFSS Environmental Surveillance Report, 1987.) - For 1987, 1988 and 1989 the background concentration of total uranium in the upper water-bearing zone was not measured, since a background of less than 3.0pCi/L had been established for total uranium. In 1990 a new on site background monitoring well, 20S, was drilled on the NFSS in the location shown in Appendix A3 and the background for total uranium immediately increased to 8 pCi/l from the formerly recognized value of <3 pCi/L. Table 3.8 and Figure 3-4, Appendix A3, (NFSS Environmental Surveillance Report, 1992.). - In 1993 total uranium measured 13 pCi/L in well 20S. In 1996 a historical average value for background total uranium in the upper groundwater was calculated as 7.59 pCi/L using the data from well 20S (now referred to as B02W20S) from 1992-1996. In 1997 the historical average background for total uranium was 7.60 pCi/L (measured in 1997 as 7.68 pCi/L.)	Historically the background concentrations of uranium in the upper water-bearing zone at the LOOW vicinity have not consistently been less than 3 pCi/L, even though this conclusion can be reached using the information given in Table 3-8 of the 1986 Environmental Surveillance Technical Memorandum documenting the findings of the Environmental Surveillance Program as noted in this comment. The compilation given in Table 3-8, as cited in this comment, over-simplifies the results. It does not include one of the background locations originally used by the Department of Energy (location 18) and is used on a conversion factor that is lower than what is currently being used to convert uranium mass to activity. The results cited in this comment for well B02W20S are generally somewhat higher than those given for other background wells in the preceding response, but are not so much higher as to invalidate this well as representing site background concentrations for the purposes of the Environmental Surveillance Program. The concentrations of uranium in upgradient wells used to establish background groundwater concentrations for NFSS are comparable with naturally occurring concentrations of uranium in groundwater, as indicated in surveys of drinking water sources cited by U.S. Environmental Protection Agency in promulgating the uranium Maximum Contaminant Level for drinking water sources and are believed to be protective of human health and the environment. For the purposes of the RI, several off-site wells were sampled. The background concentration of uranium in groundwater would be expected to have seasonal and location-based variations. The concentrations cited in this comment are very consistent over time, as would be expected for a background well. The movement of the location of the background monitoring well on to property that is currently controlled by the Corps was not done to “artificially increase” the background uranium concentration, but rather to maintain greater ease of well control access issues over the well. The current background well is believed to accurately represent background concentrations for this area.

Number	Comments	Response
13b (cont.)	The total uranium background as measured in well B02W20S was recorded annually as: 9.95 pCi/L in 1998 8.2 pCi/L 1999 8.67 pCi/L in 2000 9.37 pCi/L in 2001 10.30 pCi/L in 2002 10.60 pCi/L in 2003 8.83 pCi/L in 2004 9.81 pCi/L in 2005 8.20 pCi/L in 2006 From 2002 onward background was determined by averaging the results from well B02W20S for the period 1992 – 1997. According to the 2006 NFSS Environmental Monitoring Report (page 18) “Background concentrations for the upper water-bearing zone were determined by averaging analytical results from 1992 through 1997 for the appropriate constituents at monitoring well B02W20S. This well was selected to represent background because it is distal from and not down gradient of the IWCS. Additional background groundwater was sampled in 2003 from wells hydraulically up gradient from operations at the adjacent property of Modern Landfill. Since this data, compiled for the RI, was comparable to historic groundwater concentrations from B02W20, this well was verified to be representative of background conditions.”	Note also, that the concentrations of uranium in upgradient wells used to establish background groundwater concentrations for NFSS RI are comparable with naturally occurring concentrations of uranium in groundwater, as indicated in surveys of drinking water sources cited by U.S. EPA in promulgating the uranium Maximum Contaminant Level for drinking water sources. Please see the Technical Support Document found at this webpage http://www.epa.gov/ogwdw000/radionuclides/regulation.html. The background screening level used for NFSS for uranium in groundwater is also below the uranium Maximum Contaminant Level, and so is protective of human health. In addition, the background values for total uranium in groundwater were used only to identify site-related constituents and to determine whether the NFSS was responsible for groundwater impacts, which is positively declared in the RIR (i.e., identify site-related compounds). The background value does not dictate risk or potential cleanup goals, which will drive FS-based remedial decisions.

Number	Comments	Response
13c	"Background" groundwater monitoring wells used for the NFSS RI are sited on Modern Landfill, a former NFSS Vicinity Property which is known to have been previously impacted by both Department of Defense and Department of Energy operations, including outside storage of thousands of drums of K65. What is the basis for the assertion that Modern Landfill property is believed to be un-impacted by site operations? The fact that groundwater data from Modern Landfill is comparable to that from NFSS well B02W2S, does not verify that well B02W2S is representative of background conditions, but instead serves to illustrate how widespread groundwater contamination is on both the NFSS and the surrounding areas of the former LOOW site.	Groundwater contamination is present at the NFSS and the extent of this contamination was documented in the RIR based on the characterization data obtained to date (RIR, Section 4.9 and 5.1.2). It is correct that Modern Landfill is a former NFSS Vicinity Property. However, it is not correct to conclude that since groundwater data from Modern Landfill are comparable to that for NFSS well B02W20S, that widespread groundwater contamination exists in this area. Rather, it serves to confirm that groundwater at Modern Landfill is currently not contaminated by activities formerly conducted at NFSS. Since wells at Modern Landfill are upgradient from the NFSS wells, the only way they could be contaminated from Manhattan Engineer District material would be if extensive storage of Manhattan Engineer District waste was done in their vicinity at Modern Landfill. Modern was a vicinity property, but there is little evidence that radiological materials were stored in this area All available analytical, well construction and water level data for the wells located within the portion of the Modern Landfill site covered by the right-of-entry were tabulated and evaluated. None of the available analytical data suggested that the groundwater at Modern Landfill had been impacted by past activities. All twelve wells screened in the upper water-bearing zone and eighteen wells screened in the lower water-bearing zone were selected for sampling, though three of the lower water-bearing zone wells were later found to be damaged and unsuitable for sampling. For both water-bearing units, wells were selected to provide a good spatial representation of the area covered by the right-of-entry. The selected wells were also finished screened in subsurface materials that were similar to what was encountered at the NFSS.

Number	Comments	Response
13c (cont.)		All background groundwater samples were analyzed for the following parameters: • Radiological Parameters, • Gross Alpha/Beta, • Total Uranium, • Metals, • Volatile Organic Compounds, • Polyaromatic Hydrocarbons, • Semi-Volatile Organic Compounds, • Pesticides/Polychlorinated Biphenyls, and • Nitroaromatic Compounds. Background concentrations for radiological parameters, gross alpha/beta, total uranium, and metals were later statistically determined. Groundwater samples collected from two wells were later excluded from the background data set because the radiological results indicated that the groundwater in those wells may have been impacted by past activities at the NFSS. The other parameters were evaluated to determine if historic operations at the Modern Landfill site may have impacted the samples. This evaluation found no evidence of man-made impact.

Number	Comments	Response
13d	It is important to establish an accurate value for background uranium in groundwater at the NFSS (and LOOW site) since this may impact future remediation efforts. According to the Army Corps of Engineers, in a recent paper, "*Utilizing Isotopic Uranium Ratios in Groundwater Evaluations at NFSS*", 2006, "Evaluating the background concentration of uranium in groundwater at NFSS is central to both determining the nature and extent of site contamination and supporting assessments of human health and ecological risks." "Cleanup decisions for groundwater can have substantial cost implications, so the ability to distinguish between ambient and those reflecting site contamination is crucial." The designated background for uranium has tripled since 1989, as a direct result of siting "background" wells in contaminated locations.	The Corps concurs with the need to establish an accurate value for background uranium in groundwater at NFSS. The collection of background data was planned with input from many. The New York State Department of Environmental Conservation reviewed the initial Statement of Work and determined that the Modern Landfill site was a suitable location for the collection of background groundwater samples (RIR, Section 2.1). The New York State Department of Health reviewed the Field Sampling Plan Addendum. The Corps- Buffalo, USACE- Corps Baltimore, SAIC, Modern Landfill representatives, and the Tetra Tech Independent Technical Review Team also reviewed the Field Sampling Plan Addendum to insure that the samples would be representative of the background conditions in the vicinity of the NFSS. All review comments were resolved prior to the collection of the background groundwater samples and the reviewers agreed that Modern Landfill was an acceptable location for the collection of background groundwater samples.

Number	Comments	Response
14	Uranium has been shown to be very soluble in the groundwater of the UWBZ at the NFSS (LOOW) site. Uranium in solution is also poorly retarded by the clay soils, which contrasts with radium on site, which has been shown to be retarded by the NFSS (LOOW) clay soils. The committee believes that the first indication of contamination leaching out of the IWCS is likely to be elevated levels of uranium in groundwater. The uranium groundwater plumes in the upper water-bearing zone, immediately outside the IWCS, are therefore of great concern, particularly the plumes south of the IWCS, where the uranium levels are very high and the integrity of the clay cut-off wall is questionable.	Long-term trends in the Environmental Surveillance Program data indicate that the IWCS is performing as designed. The uranium groundwater plume south of the IWCS is believed to be associated with historic operations and methods used during the decontamination of former Building 409 along with nearby residue storage activities conducted prior to the construction of the IWCS cut-off wall. A review of the data for locations associated with this plume (TWP-833, OW-6A, OW-11B, and manhole MH06) will be as presented in the RIR Addendum (Section 4.1.2 and 4.5). In addition to the Groundwater Flow and Contaminant Transport Model, which was used to predict contaminant migration under baseline (current) and three worst-case scenario conditions (Groundwater Model, Section 4.5), Environmental Surveillance Program monitoring is conducted regularly around the perimeter of the IWCS. Environmental Surveillance Program monitoring indicates seasonal fluctuation of uranium concentrations in groundwater, not an increasing trend over the past several years. (See Figure 26 of the 2007 Environmental Surveillance Technical Memorandum at http://www.lrb.usace.army.mil/fusrap/nfss/index.htm#EnvSurv). Although the prevalent flow of groundwater at the NFSS is to the northwest, additional wells were installed south of the IWCS to delineate the Building 409 groundwater plume located south of the IWCS. The results of this analysis will be presented in the RIR Addendum (Section 4.5).

Number	Comments	Response
15	In regards to the “total uranium” groundwater plume immediately south of the IWCS, the committee requests clarification of the analytical data for temporary well point TWP833. The 2007 NFSS RIR documents sample GW-TWP833-3511 as having a concentration of 9580 µg/L of total dissolved uranium. This value does not correlate with the analytical data given for the individual uranium isotopes in the same sample. Is this a typographic error? Will USACE release a Correction Sheet? Regardless of this discrepancy, uranium concentrations in sample GW-TWP833-3511 are very high.	In researching the dissolved uranium plume it was found that the concentration of dissolved total uranium at temporary well point TWP833 in the center of the plume located south of the IWCS (RIR Figure 5-4), had been misreported by the laboratory. The reported concentration of 9,580 µg/L at TWP833 is incorrect. The actual concentration (958 µg/L) is 10 times lower than what was reported in the RIR but still well above the dissolved total uranium background concentration of 16.7 µg/L. A discussion of the incorrect concentration reported for TWP833 will be included in an RIR Addendum (Section 4.5), and the uranium plumes will be redrawn to reflect the lower concentration and omission of pipeline data from the plume delineation (RIR Addendum Figure 4-5).

Number	Comments	Response
16	Review of the groundwater samples taken south of the IWCS and the rationale given for these samples, indicates that five temporary well points were sampled to evaluate the integrity of the subsurface clay dike near the southern perimeter of the IWCS and another six temporary well points were sampled to investigate the presence or absence of radiological and non-radiological compounds in the groundwater associated with Building 409. (3) Sample GW-TWP833-3511, one of the samples taken to evaluate the integrity of the southern clay dike, was found to contain high levels of uranium, casting doubt on the integrity of the dike at this location and opening up the possibility of contamination beginning to move out of the IWCS. Building 409 has been identified as a potential source of the high levels of uranium in groundwater south of the IWCS, notably that found in sample GW-TWP833-3511. However, the six groundwater samples taken specifically to investigate radiological contamination associated with Building 409 do not support this theory: uranium concentrations were all relatively low. The committee would like documentation on all further investigations that are planned concerning the issue of potential leakage of the IWCS along the southern dike. Further, what other data gaps have USACE identified in the course of their RI for the NFSS and what plans are there to address these data gaps?	The uranium contamination in temporary well point TWP833 is believed to be associated with the former Building 409 groundwater plume, which was derived from both Building 409 operations and nearby radioactive materials storage. In researching the dissolved uranium plume it was found that the concentration of dissolved total uranium at temporary well point TWP833 in the center of the plume located south of the IWCS (RIR Figure 5-4), had been misreported by the laboratory. The reported concentration of 9,580 µg/L at TWP833 is incorrect. The actual concentration (958 µg/L) is 10 times lower than what was reported in the RIR but still well above the dissolved total uranium background concentration of 16.7 µg/L. A discussion of the incorrect concentration reported for TWP833 will be included in an RIR Addendum (Section 4.5), and the uranium plumes will be redrawn to reflect the lower concentration and removal of pipeline data from the plume delineation (RIR Addendum Figure 4-5). A review of the data for locations associated with this plume (TWP-833, OW-6A, OW-11B, and MH06) indicate that historic use of the pipelines was the primary cause of contamination in MH06, rather than infiltration from surrounding materials. During development of plume figures for the 2007 RIR, water samples collected from subsurface utilities, including manholes and pipelines, were used to interpret plume configuration because it was believed that the manholes and pipelines were in direct contact with the groundwater and that bedding material placed adjacent to the pipelines could have served to increase flow of groundwater around the pipelines (RIR Addendum, Section 4.1.2). Recent review of pipeline installation details have revealed that bedding material was typically not used during pipeline installations. Also, there is no evidence to assume that manholes and pipelines are in constant contact with groundwater. Therefore, using water sampling results collected from manholes and pipelines to interpret plume configuration is now believed to be an overly conservative approach that inaccurately characterizes site groundwater conditions and results in a misrepresentation of the nature and extent of groundwater contamination at the NFSS. Thus, water collected from subsurface manholes and pipelines will be excluded from the development of groundwater plume

Number	Comments	Response
16 (cont.)		configuration for the RIR Addendum (Section 4.1.2). Low uranium concentrations in groundwater samples collected in the vicinity of the former Building 409 location allow for more precise delineation of the existing plume but give little information regarding the source of the plume.
17	The committee found the 2007 and partial 2008 surveillance data on the new Buffalo District Website. These data are being reviewed and incorporated into existing time-line analyses.	Noted.
18	The timing of the FS recommendations was discussed again. The outcome was the action to question USACE about the opportunity to present the Committee recommendations on the scope of alternatives to evaluate. (One day later the Buffalo District announced plans and an outline of the FS. This announcement implies that a contractor has been hired and the process has begun.)	The Corps recognizes the importance of early, constant, and responsive relations with communities affected by the NFSS and welcomes community input and recommendations regarding the FS. The objective of the RI/FS process is to gather information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site. The appropriate level of analysis to meet this objective can only be reached through constant strategic thinking and careful planning concerning the essential data needed to reach a remedy selection decision. As hypotheses are tested and either rejected or confirmed, adjustments or choices as to the appropriate course for further investigations and analyses are required. These choices, like the remedy selection itself, involve the balancing of a wide variety of factors and the exercise of best professional judgment. The Corps will continue to gather information and meet regularly both internally and with the public to assess potential remedial actions feasible for the site. The current plan for the FS involves the development of interim deliverables that will be made publicly available for comment to ensure public input throughout the FS process.

Number	Comments	Response
19	"*Report on the Documentation and Data Gaps Relevant to the Containment of Radioactive Residues in the IWCS*" (2008, USACE: Letters 4-11 to 5-4-2008). Letters attached. Escape From The Residues In Buildings 411, 413 And 414 1) Failure of plugs and or leakage due to poor surface preparation and 2) Infiltration of rainwater and irrigation water into residues will produce additional leachate and 3) Failure to repair piezometers to monitor hydraulic conditions in residues. "It's understood that the sealing of subsurface pipelines associated with the former LOOW water treatment plant is a concern to the community. However, the pipe seal competence is likely longer term issues since hydraulic heads are not expected to force movement for 200-300 years." (USACE: Letter 4-30-08, p.2) The premise is that the model estimates of the Hydraulic heads inside the 411 foundation can be trusted without reinstallation of piezometers to validate the model. Also question posed by the Radiation Committee at the 09-10-08 USCAE Public meeting: "Will the piezometer well inside the Building 411be repaired or replaced? We need the data to determine the ground water level inside the residue storage buildings and whether there is evidence of rainwater accumulation and/or seasonal variations produced by flow into and out of the structure."	The Corps concurs that current information regarding the physical condition of pipeline seals is unavailable, but, as stated in the cited letter, this is likely a long term issue since hydraulic heads are not expected to force groundwater movement within the IWCS for 200-300 years. Contamination from the IWCS has not been identified in the Central Drainage Ditch, upper water-bearing zone or the lower water-bearing zone (RIR, Section 5.6.1). Available records indicate that legacy piping was truncated within the IWCS, and no information has been identified to refute this finding. An RIR Addendum is being prepared that will discuss/include: • Reference to LOOW Underground Utilities Remedial Investigation for offsite pipelines (RIR Addendum, Section 10.2) • South Dike Piping Plan and Schedule (RIR Addendum, Appendix 5-B). Further documentation regarding the configuration of pipes and drains in the former LOOW water treatment and distribution system (Buildings 409-415) is provided in Section 4.2 of the *Comprehensive Characterization and Hazard Assessment of the DOE-Niagara Falls Storage Site* (Battelle 1981). This report includes a summary of pipes and connections between the residue storage buildings, as well as the 42 inch supply line, along with documentation regarding the condition of the pipeline (i.e. functional, sealed, severed, plate sealed, etc.). This report notes that the 42-inch water line originally designed to bring water from the Niagara River had been severed by the Town of Lewiston, near Pletcher Road, during the summer of 1979. Invasive investigations into the IWCS are not planned and this data gap will be accounted for in the FS using conservative assumptions regarding internal IWCS conditions derived from the geophysical surveys.

Number	Comments	Response
19 (cont.)		In 1986, 13 vibrating-wire pressure transducers were installed to monitor pressure changes within the IWCS. Not long afterwards, this system was destroyed by lightning. At this time it is believed that the costs and potential risks to workers and the environment from breaching the containment system to install and sample piezometers in the IWCS is not justified based on the information that could be gained. Currently, there are 22 nested well pairs in the immediate vicinity of the IWCS that are used to measure water levels adjacent to the IWCS.
20	"*Report on the Documentation and Data Gaps Relevant to the Containment of Radioactive Residues in the IWCS*" (2008, USACE: Letters 4-11 to 5-4-2008). Letters attached. Escape From The Residues In Buildings 411, 413 And 414 Concrete failures at location of cracks, leaks and produced by excessive loading. "Additionally, wick drains were installed in the bays to dewater the residues to the extent possible and the encapsulation of the buried buildings should not produce significant structural differentials and cracking since they are removed from aerial exposure and somewhat in dynamic equilibrium with ambient geology." (USACE Letter 4-30-08, p.2).	The geophysical studies of the IWCS indicated that Building 411's outer walls were reinforced and are still competent (RIR, Appendix C). Encapsulation of the buried buildings should not produce significant structural differentials and cracking since void spaces were filled with concrete to prevent settling and the building was removed from aerial exposure. The building is currently believed to be in a continuous state of balance with the surrounding geology lending to its continued competency.

Number	Comments	Response
21	"*Report on the Documentation and Data Gaps Relevant to the Containment of Radioactive Residues in the IWCS"* (2008, USACE: Letters 4-11 to 5-4-2008). Letters attached. Escape From The Residues in Buildings 411, 413 and 414 Flow into and along foundation bedding under buildings: "The Building 411 foundation fill described in the cut-off wall log is not a sand lens." (USACE Letter 4-30-08, p.2) There is no data on the fill under Building 411. And "The team looks forward to more closely focusing on items that the Radiation Committee has included in their assessment as it relates to the short and long-term effectiveness in the Feasibility Study." (USACE Letter 4-30-08, p.3) When radioactivity liquids flow under the buildings the scope of demolition and excavation dramatically increases the cost of remediation. It will be necessary to sample the ground water near the residue building foundations for radioactive contamination before preparing any Feasibility Studies.	The statements that the Building 411 foundation fill is not a sand lens is based on observations of the layback and fill around Building 411, which is indicative of a slab concrete foundation and not vertical excavation with steel piles. Steel would have been in high demand during the wartime construction of Building 411 and the Glacio-Lacustrine Clay surrounding the structure would have molded around the foundation with time. In addition, the ongoing Environmental Surveillance Program monitors changes in groundwater quality. In the event that concrete structures which contain the waste residues were breached, the Environmental Surveillance Program would likely detect leading edge plume concentrations. Currently there is no evidence that such a breach has occurred or that waste residues are migrating from beneath the IWCS. The technical challenges associated with the demolition and excavation of radiologically contaminated materials is noted. If, during the FS, it is determined that additional information regarding the contents or performance of the IWCS is needed, appropriate steps will be taken to gather the needed information.

Number	Comments	Response
22	"*Report on the Documentation and Data Gaps Relevant to the Containment of Radioactive Residues in the IWCS*" (2008, USACE: Letters 4-11 to 5-4-2008). Letters attached. Escape from the Residues in Buildings 411, 413 and 414 Flow into the residues from below during the spring and flow out during the dry season consequently raising and lowering the saturated zone inside Building 411 "High groundwater levels in the LWBZ will slow downward transport by "seasonally perching" the IWCS material, as driven by upward pressures in the Glacio-Lacustrine clay (GLC) (from the alluvial sand and gravel and fractured Queenston shale bedrock units). A weak vertical (downward) gradient through the GLC was assigned in the numerical model to conservatively accounts for this seasonal hydrodynamic effect (i.e., the downward gradient assumed all year long); again we're forcing transport in the model due to the "buttoned up" or contained nature of the IWCS." (USACE Letter 4-30-08, p.2) As well as "vertical gradients vary with season, with 2/3 of the year being upward or equilibrated" (USACE Letter 4-30-08, p.2)	The quantity of water that will flow through a unit cross-sectional area of porous material per unit of time is governed by Darcy's Law: $q = Ki$, where "K" is the hydraulic conductivity of the porous medium and "i" is the gradient. Exploring plausible values of hydraulic conductivity (K) and gradient (i) as pertaining to former Buildings 411, 413 and 414 suggest that vertical upward flow into the waste residues is unlikely during seasonal events that cause an upward gradient. With respect to hydraulic conductivity (K), the concrete walls and flooring of former Buildings 411, 413 and 414 are assumed to be intact and of low permeability; much lower than the native material surrounding former Buildings 411, 413 and 414. If sustained upward gradients were to occur, then groundwater leakance upward into the IWCS-enclosed upper water-bearing zone still would not be under lateral migration potentials due to cut-off wall containment, meaning transport from possibly degraded concrete structures would be limited to the proximate building area for 200 years. With respect to gradient (i), as stated in Section 2.5.1 of the Groundwater Model Report, the low hydraulic conductivity of the Glacio-Lacustrine clay ensures that the actual flow rates through the clay will be minimal for even the highest gradients observed. It has not been confirmed that upward gradients exist below the IWCS.

Number	Comments	Response
23	"*Report on the Documentation and Data Gaps Relevant to the Containment of Radioactive Residues in the IWCS"* (2008, USACE: Letters 4-11 to 5-4-2008). Letters attached. Downward Leakage Past The GLC Sand pockets that penetrate the GLC "Groundwater modeling (which assumed no cutoff wall/dike existed) indicates that the sand lenses on-site are both vertically and laterally discontinuous and leaching beneath Building 411 will occur (i.e. uranium will leach above background levels) within a 200 year timeframe." (USACE: Letter 4-30-08, p.2)."	The observed lithology of the Glacio-Lacustrine Clay is homogeneous with intermittent sand pockets, which is consistent with its depositional origin: a low energy glacio-lacustrine environment (Groundwater Model, Section 2.3.1). During the RI, hundreds of geologic logs for monitoring wells or boreholes installed at the NFSS that fully penetrate the upper clay till were used to construct three-dimensional structure maps of the glacial deposits. These subsurface structure maps provide a visual profile of glacial deposits at depth. In addition to the subsurface profiles, a geostatistical study of these borings was conducted and concluded that the sand lenses are not interconnected over distances greater than 15 to 20 feet horizontally and over 4 to 5 feet vertically. After the RI was completed, it was discovered that the Phase 3 soil boring logs had been omitted from the calculation of sand lens inter-connectivity. Recalculation of the sand lens inter-connectivity incorporating these boring logs will be included in the RIR Addendum (Section 12-10 and Appendix 12-J). The sand lenses were not discretely modeled in the upper clay till because they are not expected to transport IWCS-based chemicals of concern farther, in the long term, than the low permeability upper clay till will allow. Higher hydraulic conductivity values from wells with larger sand lenses contribute to the overall K values used in the model and provide statistical conservatism in select zones of the model. Hydraulic conductivity, symbolized as K, is a property of soil or rock that describes the ease with which water can move through pore spaces or fractures. It depends on the intrinsic permeability of the material and on the degree of saturation. Over 200 groundwater samples were collected from temporary and permanent wells at the NFSS. Because the Glacio-Lacustrine Clay acts as an aquitard, separating the upper water-bearing zone from the lower water-bearing zone, groundwater plumes containing radionuclides, metals and organic compounds were identified in the upper water-bearing zone, and not in the lower water-bearing zone.

Number	Comments	Response
24	Downward Leakage Past The GLC Test borings and/or pilings under buildings prior to original building construction "The layback and fill around 411 is indicative of slab concrete foundation and not vertical excavation with piles (steel would have been too precious at that time to spend on un-needed piles - the GLC would have molded around them with time and vertical gradients vary with season, with 2/3 of the year being upward or equilibrated)." (2008, USACE: Letters 4-11 to 5-4-2008, p.3).	There is no evidence that the Glacio-Lacustrine Clay is penetrated by a piling placed prior to Building 411 construction.
25	Horizontal Leakage to and Past Clay Cutoff Walls Lack of evidence that all pipes intercepting the clay cutoff walls were sealed at the wall interface "It's understood that the sealing of subsurface pipelines associated with the former LOOW water treatment plant is a concern to the community. However, the pipe seal competence is likely a longer term issues since hydraulic heads are not expected to force movement for 200-300 years. Additionally, the piping to the Central Drainage Ditch is truncated by the cut-off wall that is down to ~305 ft in elevation." (2008, USACE: Letters 4-11 to 5-4-2008, p.3)	The south dike piping plan and schedule illustrates the plan for removal and plugging of the pipelines with non-shrinking concrete before construction of the dikes. This document will be included in the RIR Addendum (Appendix 5-B). Although it is true that current information regarding the physical condition of pipeline seals is unavailable, the Corps believes, as stated, that this is likely a longer term issue, since hydraulic heads are not expected to force groundwater movement for 200-300 years.

Number	Comments	Response
26	Horizontal Leakage to and Past Clay Cutoff Walls Lack of geophysical investigation of the cutoff wall south, east and west of Building 411 "The Geophysical Survey of the IWCS indicates no short-term competency issues (e.g. cap settling, cutoff wall/dike failure, seismic vulnerabilities, etc.) within the IWCS. USACE acknowledges that there are limitations associated with this survey methodology. These limitations were leveraged to the extent possible by integrating other geophysical survey methods. This investigation was not a stand alone integrity assessment, but used as an additional weight of evidence in our integrity investigation." (2008, USACE: Letters 4-11 to 5-4-2008, p.3) Also question posed by the RAD Radiation Committee at the USCAE Public meeting What technology will USACE use to verify the integrity of the clay wall between Building 411 and the Central drainage Ditch?	The geophysical survey of the IWCS included in the RI and the ongoing Environmental Surveillance Program indicate no short-term competency issues (RIR, Appendix C). Non-intrusive means were used in the RI to assess the integrity of the IWCS in its current state in order to maintain the protectiveness of the cover. Since sufficient information is available to complete the FS, no additional in-field survey technologies are planned to assess the contents of the IWCS or the clay cutoff wall integrity. The Central Drainage Ditch and select feeder ditches are sampled routinely under Environmental Surveillance Program for a large suite of analytes. Results of this sampling continue to show low to non-detectable levels of radionuclides. To further address the integrity of the IWCS, the RIR Addendum will include a detailed description of how the Environmental Surveillance Program is used to demonstrate cap and cutoff wall integrity (Section 5.0).

Number	Comments	Response
27	Horizontal Leakage To and Past Clay Cutoff Walls Poorly located monitoring wells "Lastly, contamination from seepage of the IWCS has not been identified in the Central Drainage Ditch, or upper and lower groundwater-bearing zones, further indicating that legacy piping is truncated within the IWCS; and any remnant external piping should not affect the long-term competency of the cell." (2008, USACE: Letters 4-11 to 5-4-2008, p.3)	The lack of evidence for seepage from the IWCS should not be attributed to poorly located monitoring wells. Monitoring well locations have been reviewed by the New York State Department of Environmental Conservation and U.S. Environmental Protection Agency since the inception of the Environmental Surveillance Program in 1981, and there have been no concerns expressed regarding well placement. Moreover, the absence of seepage from the IWCS is documented by a combination of study results from the RI and the extensive monitoring regularly conducted under the surveillance program, not from results of the RI alone. The objectives of groundwater investigations conducted at the NFSS were to define the nature and extent of chemical and radiological contamination, evaluate the potential release of contamination from the IWCS to the groundwater and investigate the potential for groundwater to infiltrate into the IWCS. To achieve these objectives, groundwater was characterized using a phased approach and initial characterization activities were used to optimize well placement and subsequent investigative efforts. In addition, the Central Drainage Ditch and select feeder ditches are sampled routinely under the Environmental Surveillance Program for a large suite of analytes. Results of this sampling continue to show low to non-detectable radionuclide levels in the Central Drainage Ditch.

Number	Comments	Response
28	Horizontal Leakage To and Past Clay Cutoff Walls Hydrological model treats only the bulk properties of the soils and clay layers. Also question posed by the RAD Radiation Committee at the USCAE Public meeting: Will USACE refine the computer groundwater model with fine scale details of the wall of the buried buildings, the pipeline locations and the clay wall? The result may be dramatically different and demonstrate the sensitivity of the output to initial conditions.	The Corps has no plans to refine the groundwater model. The model is not intended for high-resolution simulation of small scale features. The model is designed to provide predictions on the order of years, decades and millennia (Groundwater Model, Section 1.3). Predictions are based on assigned values of bulk hydraulic conductivity for the various hydrostratigraphic units and physical systems. Localized variations in permeability due to isolated sand lenses or abandoned and sealed pipelines embedded in a low-permeability matrix will not have a material effect on large-scale contaminant transport from a proximal array of point sources.
29	Horizontal Leakage To and Past Clay Cutoff Walls No explanation for the above average radon flux measurements in the southeast and southwest corners of the IWCS as reported in the 2006 NFSS Environmental Surveillance Technical Memorandum.	Radon fluxes at any given location on the IWCS cover can vary from year to year for a number of reasons. The main point is that all values are well below the 20 pCi/m^2/s standard, and are not increasing. The measured radon fluxes on the IWCS cover are comparable to those for native soils in the area. Radon-222 concentrations in air have been measured at the IWCS perimeter and NFSS perimeter for many years, and these concentrations have consistently been comparable to those for nearby background locations. Radon results are reported annually in the Environmental Surveillance Technical Memorandum. Radon 222 will be evaluated further during the FS when developing alternatives that involve removal of the residues and wastes from the IWCS. However, current radon concentrations at the site are not elevated and not a significant concern for the remainder of the site, which was the focus of the RI. The presence of radon isotopes was addressed in the RI by reporting of information for the two parent radionuclides, radium-226 and radium-228. The Corps is currently developing a radon assessment technical memorandum as part of the FS process to address potential exposure concerns to radon gases and their short-lived progeny.

Number	Comments	Response
30	Page 1-10 The fact that there were no criteria for uranium or cesium-137 until 1988, which is after most of the previous NFSS cleanup was done, is troubling and raises questions about the adequacy of previous cleanups. The apparent widespread presence of surficial contamination and some subsurface contamination found at NFSS supports this concern.	Concern regarding lack of standards during the execution of remedial activities at the NFSS is noted. However, the FS is being conducted to address any remaining contamination from past site activities using current remedial standards consistent with the CERCLA process.
31	Department of Health Page 1-11 The underdrain from Building 411 (currently storing radioactive residues) must have drained somewhere and should have been sealed. This should be documented and an indication provided that exterior drains were sealed adequately in order to last for the duration of the facilities life and that monitoring of potential leaks can occur.	Unpublished construction reports from 1986 indicate that the off-gas and dewatering system in Building 411 was dismantled. The building (including the bays and dewatering wells) was also filled with fillcrete and/or bentonite at this time. The South Dike Piping Plan and Schedule, which shows the plan for pipeline removal and sealing, and the LOOW Completion Report with Building 411 construction drawings will be included in the RIR Addendum (Appendices 5-B and 12-B).

Number	Comments	Response
32	Department of Health Page 2-6 The fact that deposits of sand and gravel up to 20 feet in thickness occur in the Brown Clay Unit is important, as that nears the total thickness of the unit. This reduces potential low-permeability protection of this layer.	Occasional thicker units of sand and gravel may occur within the Brown Clay Unit, but this is not generally the case (Groundwater Model, Section, 2.2.2.3). Of more than 100 sand lens occurrences identified during the groundwater modeling process, the average sand lens thickness was determined to be 3.8 ft, with a maximum of 17 ft. Furthermore, the sand lenses are not evenly distributed throughout the subsurface at the NFSS. The intermittent sand lenses are generally vertically and horizontally discontinuous and likely do not represent a continuous water-bearing zone or aquifer. Geostatistical analyses indicate that the sand lenses cannot be correlated over horizontal distances greater than about 20 ft. Water levels observed in wells screened across sand lenses do not appear to be correlated which suggests that the sand lenses are not hydraulically connected (RIR Addendum, Section 12.8). In the RIR Addendum, the occurrence of sand lenses will be studied in closer detail to determine if there is a higher density of sand lenses near the IWCS (RIR Addendum, Section 12.10 and Appendix 12-J). To do this, the Corps will update plots of wells with and without sand lenses and incorporate data from the visual logs, or cross-sections recorded during construction of the IWCS cut-off wall.
33	Department of Health Page 2-11 Climate data used for NFSS monitoring and analyses should be collected on site. Use of data from Niagara Falls Air Force Base located seven miles southeast and above the Niagara Escarpment is inappropriate and is a significant data gap. The incremental cost of installing a basic meteorological station at NFSS is negligible compared to the cost of ongoing maintenance and value of site data.	We appreciate the concern raised in this comment and have looked at using meteorological data from stations closer to the site. However, there are a number of concerns with these data including quality control and assurance. There does not seem to be a need for an onsite meteorological station at this time, but this concern will continue to be evaluated. This is mainly an issue during the remedial action period, especially if a decision is be made to remove the high activity residues from the site. For the NFSS Groundwater Flow and Contaminant Transport Modeling monthly precipitation rates were measured in Lewiston, NY, which is approximately 1.5 miles from the site and is sufficiently close to predict on-site meteorological conditions (Groundwater Model, Section 2.1.1).

Number	Comments	Response
34	Department of Health Page 3-3 The annual dose limit of 100 mrem/yr above background for the public is the DOE primary standard (DOE Order 54005), and applies to all exposures pathways. For NFSS, which contains a fenced storage area, some public exposure could occur only through airborne emissions. In that case, the exposure should be limited to only 10 mrem/year. If NFSS is a disposal facility, then the appropriate dose would be 25 mrem/yr. The rationale as to why the dose limit is 100 mrem/yr should be explained.	As noted in this comment, a dose limit of 100 mrem/yr is the Department of Energy's primary standard for the public and applies to all exposure pathways. Potential airborne releases from the site are evaluated annually as part of the Environmental Surveillance Program, and the data are compared to the National Emission Standards for Hazardous Air Pollutants (NESHAP) annual dose limit of 10 mrem/yr, as noted in this comment. It is also correct that if this site were a Nuclear Regulatory Commission-licensed low-level waste disposal site (which is not the case), the appropriate standard would be 25 mrem/yr. A dose limit of 100 mrem/yr is used as a reference value for a general comparison to the estimated overall annual radiation dose to an off-site worker and a resident near NFSS. Since DOE had responsibility for this site for many years, and will again following the completion of any necessary remedial actions, this standard was felt to provide a reasonable point of reference in the RIR. Potential Applicable or Relevant and Appropriate Regulations, including those that specify dose-based cleanup standards, will be examined in the FS.
35	Department of Health Page 3-6 The fact that Outfall 2 was a banded wooden pipe suggests that there were other wooden pipes installed at the time of LOOW plant construction. The inevitable loss of integrity of the wooden pipes is a concern due to the likelihood of enhancing subsurface migration.	Concur that loss of integrity of wooden pipes is a potential concern. However, this storm sewer outfall and the main water intake (42-inch pipeline) are believed to be the only wood encased pipelines on-site based on historical documents and as-built construction drawings (RIR Addendum, Appendix 12-B). There are more than 21,000 feet of fresh water lines reported as being made of cast iron (RIR, Section 3.5.2). The composition of the storm water, sanitary and acid sewer lines is reported as vitreous clay pipe. The LOOW Underground Utilities Remedial Investigation provides information regarding pipe conditions and construction, both of which show generally good pipe competency (and an ability to house contamination as evident on both sites). The LOOW Underground Utilities Remedial Investigation also revealed that pipelines leaving the NFSS (sanitary sewer and acid waste lines) are encased in concrete. Additional information regarding offsite transport of contamination via pipelines will be presented in the RIR Addendum (Section 10.5).

Number	Comments	Response
36	Department of Health Page 3-7 It is stated that enough unbiased samples were collected to ensure adequate data coverage for each constituent and media in each Exposure Unit for risk assessment purposes. It is not clear how the number and locations of samples were determined.	The total number of samples taken was determined on an Exposure Unit basis to ensure that enough samples were collected from each Exposure Unit to complete a statistically valid evaluation (RIR, Section 3.1). RI sampling was conducted in a phased, generally biased approach. Phase 1 sample locations were selected using information gained from a review of historical site information and previous studies performed by other contractors (RIR, Section 1.4). Things taken into account for sample location selection included: • site history, • site topography, • locations of former buildings and slabs, • results of gamma walk-over surveys, • Photo-ionizing Detector and TNT screening results, • site drawings, • knowledge of former site activities and processes, • presence or evidence of potential contamination, and • need to provide representative sampling throughout each Exposure Unit of the site. Phase 2 and 3 sampling was performed to fill data gaps, confirm previous results and provide sufficient and representative data to characterize the subsurface soil at NFSS and support the Baseline Risk Assessment.
37	Department of Health Page 3-8 There is a discrepancy between the down hole gamma logging (Appendix K) and the borehole logs in Appendix N. For example, Boring 211has a depth of 15 feet bgs, but the gamma log profile shows a depth to > 131 ft. Also, SB 214. The gamma log for SB811 indicates a depth of 231 feet bgs.	It was noted that numerous depths of the boring logs included in Appendix K were incorrectly recorded. The graphs will be corrected and included in the RIR Addendum (Appendix 3-B).

Number	Comments	Response
38	Department of Health Page 3-9 Selection of Lew-Port school and Army National Guard Weekend Training Site as background locations for gamma radiation raises concerns since both properties were once part of the LOOW.	Background soil samples collected by EA for chemical analysis during the LOOW RI were also used for the NFSS RI (RIR, Section 3.6.1.2). Tetra Tech collected additional background samples for radiological analysis. Background sampling locations were located in the buffer area of the former LOOW. These areas were considered to be representative background sampling locations, since they are close to NFSS and show no evidence of being impacted by LOOW or NFSS site-related activities. There is no known information that indicates either DOD or Manhattan Engineer District/Atomic Energy Commission activities occurred on these sites. The NFSS RIR Table 3-5 provides a summary of background surface soil samples, the approximate distance of the background locations to the closest NFSS border, and the rationale for sample location and analysis. An outlier evaluation was performed on all the background data to confirm that no DOD or DOE-related contamination was evident in the background sampling location. Please see Section 4.4.1 of the RIR. The RIR Addendum will include a comparison of NFSS background data United States and New York area soil background levels (Sections 7.3 though 7.6).

Number	Comments	Response
39	Department of Health Page 3-14 The choice of background location BKGD-8 appears inappropriate since although it was in buffer areas, it was actually very close to roads and infrastructure associated with the TNT explosives storage and AFP-38 incinerator, railway and a drum storage area. There would seem to be other locations that could have been selected that were isolated from known activity areas. Use of Modern landfill groundwater wells as background also raises doubts since the Modern property was formerly associated with transport and unloading of materials in the LOOW and there was a former waste disposal area (Town of Lewiston landfill) which was not constructed to modern containment standards.	A review of historical documents was performed prior to selection of all background locations and rationale for the selection of background sample locations is presented in Section 4.4.1 of the RIR. For a data set to accurately portray background conditions, the data must be free from other contaminant sources. Elevated concentrations at a background location (e.g., failing a statistical outlier analysis) would suggest the potential for other impacts and, as such, would have been eliminated from the background data set. Without other sources of contamination, analytical results for a background data set are expected to be fairly uniform. Statistical outlier tests were performed to evaluate background data uniformity. These tests led to the deletion of two background wells located near a rail bed on the Modern Landfill property due to elevated uranium (PZ-21S and PZ-25S). All data from these two wells were removed from the background data set. The same approach was used for all other background media including surface soil, subsurface soil, sediment and surface water.
40	Department of Health Page 3-24 In 2000, the well development protocol was changed to maximize water clarity and reduce development time. It is hard to understand how reducing the number of well volumes removed would result in better development. However, the 2003 development criteria was appropriate in determining representative groundwater was sampled.	The development criteria were revised to maximize the clarity of the groundwater in wells that produce little water and take some time to recover after water is removed (RIR, Section 3.10.2.4). Development criteria used prior to 2000 required removal of five times the standing borehole volume; however, removal of this volume of groundwater may not have been possible at wells with limited recharge. Part of the revised development criteria required the removal of a maximum of three well volumes and pumping a well dry on three separate days. This method most sufficiently addressed the development of wells installed in low permeability units that commonly constrain well recharge. The Corps believes the wells were adequately developed.

Number	Comments	Response
41	Department of Health Page 3-27 The groundwater sampling protocols used were generally appropriate, however, the choice of using a bailer for volatile organic compounds collection is puzzling as it is the device with most variability and negative sampling bias.	The Corps acknowledges that using a bailer for the collection of samples to be analyzed for volatile organic compounds is less desirable than other methods (RIR, Section 3.10.3.1). The choice of sampling tool was dependent upon the hydraulic conditions in the permanent groundwater monitoring well or temporary well point to be sampled. In general, during Phase 1 sampling in late 1999 and early 2000, the preferred method of sampling was the use of peristaltic pump and a low flow sampling technique. This technique was established through a Standard Operating Procedure approved by the Buffalo District. In wells with depths greater than approximately 25 ft, peristaltic pumps are impractical due to the force of gravity, and in this case a submersible pump was used, if possible. At the initiation of Phase 2 sampling in September 2000, the preferred method of collection of samples, including volatile organic compound samples, was changed to the use of submersible pumps. This change was documented in a Standard Operating Procedure approved by Buffalo District Corps. In many of the temporary well points, recharge rates were very slow and the well would be completely drawn down before any water could be pumped to the surface. Also, due to turbidity, submersible pumps adjusted to slow sample collection rates tended to clog. In these cases, use of bailers, rather than pumps, was necessary. Currently, groundwater samples are collected using peristaltic pumps, and this technique will continue to be used in the future.

Number	Comments	Response
42	Department of Health Page 3-38 Ten drums of investigation derived waste contained sufficient fission products that they required separate disposal. The locations where the material in the ten drums that contained Pu-239/240 and Sr-90 originated is not noted here. The presence of these compounds at the LOOW is significant, and efforts to determine where the material came from should be pursued.	Specific locations where the material in the ten drums of investigation derived waste came from are not known. The presence of plutonium-239/240 and strontium-90 at the NFSS is most likely attributable to the storage of KAPL residues in buildings formerly located in the Baker-Smith area (Exposure Units 1 and 2) as well as in Building 401 RIR, Section 1.5.2). KAPL wastes were later transferred to Oak Ridge National Laboratory for disposal. The site-wide evaluation of transuranic and fission product data included in the RIR (Section 5.9) investigates those areas where fission products such as strontium-90 and transuranic radionuclides such as plutonium-239/240 may be located onsite. KAPL records (manifests) will be included in an RIR Addendum (Section 12.1). Additional radiological analysis to be conducted on investigative derived waste will also be presented in the RIR Addendum (Section 11.0).
43	Department of Health Page 4-5 Including potential outliers of radium-226 and thorium-230 at SDBKGD-2 in the sediment background data set requires further explanation. This location is at the upgradient portion of the West Drainage Ditch on NFSS, yet had the maximum sediment concentration values for radium-226 and thorium-230 found at NFSS and is located only 300 feet west of elevated radium-226 in soil (67.9 pCi/g). It would seem reasonable to conclude that this area had been affected by activities at NFSS and would not be considered to be background conditions.	Radium-226 and thorium-230 concentrations at SDBKG-2 were not removed as outliers from the background sediment data set (RIR, Section 4.4.1). An outlier is an observation that does not follow the pattern established by other observations. The highest concentration of radium-226 in the background sediment data set was found at SDBKGD-2 at a level of 2.43 pCi/g. Although this concentration was statistically identified as an outlier, it was not removed from the sediment data set since it was not out of range of values reported for natural radium-226 in soil and sediment at other sites. In addition, it was also only slightly higher than the outlier threshold of 1.957 pCi/g. Furthermore, the statistical outlier test did not identify thorium-230 as an outlier, so it was retained in the sediment data set.

Number	Comments	Response
44	Department of Health Page 4-7 The methodology for determination of site-related constituents (does not) appear to include any description of, or review of historical activities and likely contaminants that might have been associated with those activities. This should be a key element of any attempt to identify site-related contaminants.	A description of the records review conducted as part of the NFSS RI is included in Section 2.2 of the RIR. The RI included a historical review that preceded selection of site-wide constituents and sampling locations. Based on the review, samples were analyzed for constituents believed to be associated with site operations in that area. All analytical data was then compiled and statistically evaluated to determine the final site-related constituents.
45	Department of Health Page 4-11 Use of groundwater monitor wells on Modern Landfill property because they are upgradient and east of NFSS is not entirely appropriate. In particular five monitor wells (PZ-21D, M and S, PZ-25S, MW-17) were chosen that are located within an area known as the LOOW classification yard, and is identified as a DOD area of concern in the DERP-FUDS investigations. Radiological contamination of surficial soil did occur on the property now occupied by Modern landfill and has been remediated ((Bechtel National Inc., 1983; Bechtel National Inc., 1986; Keller E. L., 1981; Stukenbroeker, 1981). It seems more judicious selection of background locations could have been made.	Background groundwater samples were collected at locations along the boundary of the LOOW site and on Modern Landfill property (12 wells in the upper water-bearing zone and 18 in the lower water-bearing zone) (RIR, Section 4.9). The Modern Landfill site was selected to establish background levels because the wells there are hydraulically upgradient (located up slope) of the NFSS and within one mile of the site (assuring similar lithology). There are also a sufficient number of available wells completed in the water-bearing zones of interest. Additionally, well construction and geology were documented for the Modern Landfill site. The feasibility of using other wells located further upgradient from Modern was investigated; however, construction and geologic information for the other wells could not be located so these wells were not suitable background wells.
46	Department of Health Page 4-20 Fig 4-20 Very few of the groundwater locations in either the upper water-bearing zone or lower water-bearing zone do not have an exceedance of a site-related constituents.	Figure 4-20 of the RIR identifies locations where site-related constituents were detected in unfiltered samples collected from the upper-water bearing zone groundwater. Figure 4-18 shows the same information for the lower water-bearing zone. A comparison of these two figures shows that far fewer site-related constituents were identified for the lower water-bearing zone suggesting that the Glacio-Lacustrine Clay does act as an aquitard limiting vertical contaminant migration. It is important to note that sampling locations were biased toward areas were contamination was most likely to be found and that site-related constituents are defined as chemicals present at concentrations that are statistically greater than background concentrations. Site-related constituents do not necessarily present an unacceptable risk.

Number	Comments	Response
47	Department of Health Page 4-25 Fig 4-25a No soil samples are shown below 5' depth.	Concur. No soil samples were taken below a depth of 5 feet in Exposure Unit 9 because there were no historic buildings or activity in this area (RIR, Section 4.12). Sampling in Exposure Unit 9 included surface soil, sediment and groundwater.
48	Department of Health The presentation of the data is organized around the 18 Exposure Units which were defined for the BRA. However, it is unclear if the designation of the Exposure Units occurred before or after the investigation. Further clarification should be made as to the role of historical information to guide the investigation and then to divide the site into Exposure Units after review of the data.	Prior to investigation, the site was divided into investigation areas which were based on historic activities. These areas were further refined and defined as Exposure Units as the RI and Baseline Risk Assessment progressed. Please see Section 2.2.2.2 of the Baseline Risk Assessment (USACE 2007b) for further explanation of how the Exposure Units were developed.
49	Department of Health Page 5-3 The essential human nutrients listed (Fe, Mg, Ca, K, Na) are also significant elements in minerals, and are considered major cations which make up the geochemistry of groundwater and surface water. Therefore, their importance goes beyond nutrition as they are also important in understanding groundwater conditions and processes affecting subsurface contaminant fate and transport. The statements made are not incorrect, but to imply that these elements as only of concern as human nutrients is inappropriate.	The RI data set contains 25 groundwater samples analyzed for the various groundwater quality parameters, including alkalinity, cation exchange capacity, chloride, cyanide, ethane, ethene, fluoride, methane, nitrogen, orthophosphate, phosphorus, sulfate, sulfide, oxygen demand, percent moisture, total dissolved solids, total suspended solids, and total organic carbon (RIR, Section 5.1.1). In soil science, cation exchange capacity is the capacity of a soil for ion exchange of cations between the soil and the soil solution. Cation exchange capacity is used as a measure of fertility, nutrient retention capacity, and the capacity to protect groundwater from cationic, or positively charged, contamination. Although not identified as site-related constituents, these analytes were done to qualitatively evaluate groundwater conditions at the NFSS. These data were used to assess NFSS-specific groundwater chemistry and provide input to the MINTEQ geochemical model compiled for the site (Groundwater Model, Section 4.3.2.1). Groundwater conditions and processes affecting subsurface contaminant fate and transport were not overlooked.

Number	Comments	Response
50	Department of Health Page 5-4 The discussion regarding contaminated groundwater and plumes is reasonable. It is a difficult thing to draw delineated plume maps in the shallow groundwater as the site contains many complicating factors. For example, the presence of buried pipelines or infrastructure, vertical fractures in the upper clay till, unknown distribution of surface releases, groundwater-surface water interaction at ditches, non-uniform sand lens distribution may all affect the flow of groundwater and hence the migration of contaminants leading to a complicated distribution. The site hydrogeologic conceptual model should reflect the complex and difficult to monitor conditions. The plume maps that are shown only place lines around the locations where contamination was discovered, and it should be recognized that this may be incomplete and simplistic.	The extent of groundwater plumes was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. The Corps concurs that the approach used for plume map delineation was simplistic and conservative: groundwater between and adjacent to observed contamination was assumed to be part of a continuous plume (RIR, Section 5.1.2). This approach likely overestimated the plume extent and continuity, but presents the most reasonable definition of plumes given the data available. This method for groundwater plume delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated. The inherent complexities of the subsurface system listed in the comment are acknowledged, and balanced against the conservative approach that was used to complete the modeling analysis. Information regarding contaminant transport via groundwater is available in the NFSS Groundwater Flow and Contaminant Transport Model (Section 4.0).
51	Department of Health Page 5-5 The uncertainty around the location of the radium storage vault suggests that a grid based soil sampling plan would have been more appropriate to determine if contamination is present from this historical activity.	Based on readings from the gamma walkover survey (which was used to detect ground-level radium), numerous surface and subsurface soil samples were taken in the area believed to have been the location of the former radium storage vault (note: the exact location has not been identified) (RIR, Section 5.2).
52	Department of Health Page 5-6 The presence of volatile organic compounds, metals and radionuclides at depths in soil greater than 10 feet invites explanation. If radionuclides had the sorption coefficient assigned by the modeling [HGL 2007, Science Applications International Corporation (SAIC) 2007a] and actually migrated downward from the surface over a period of only 60 years, this would exceed expected travel times. This comment also applies to the presence of cesium-137 found in groundwater in Exposure Unit 1.	Subsurface soil contamination is most likely attributed to historical land disturbances. Throughout its operational lifetime, large areas of soil at the NFSS have been disturbed for TNT plant construction, road construction, the installation of underground pipelines, construction of the IWCS, drainage ditch maintenance, etc. The widespread use of treatment ponds for the residue transfer process also may have resulted in subsurface contamination (RIR, Section 1.5.3.2).

Number	Comments	Response
53	Department of Health Fig 5-1 to 5-4 The inferred uranium plumes shown in these figures indicate that the presence of uranium in shallow groundwater is widespread across the NFSS (with exception of northeast portion. a. The plumes are not fully delineated and could be much larger than shown. b. Elevated uranium occurs in shallow groundwater near the boundaries of the NFSS indicating either potential offsite (northwest) or onsite (from south or east) migration. c. There is a clear presence of uranium in groundwater along the west and north boundaries of the IWCS d. The interpreted elevated uranium along buried pipelines southeast of the IWCS is likely correct, indicating the importance of buried utilities as potential groundwater pathways.	Figures 5-1 through 5-4 of the RIR show several discrete areas of dissolved uranium contamination in the upper water-bearing zone. a. Although groundwater contamination exists in discrete areas, the available data was interpreted using the most conservative approach, delineating continuous plumes where isolated groundwater impacts may exist. b. Based upon RI findings, additional groundwater investigation was conducted at three locations during the fall of 2009 to better delineate potential off-site contaminant migration (RIR Addendum, Section 3). These areas include the area northwest of the NFSS property where the uranium plume appears to cross the site boundary onto the Town of Lewiston property (former LOOW wastewater treatment plant). Off-site testing in this area is needed to define the extent of the uranium plume. The second area of interest concerns the potential for an interconnection between groundwater to the west of the IWCS and surface water in the West Drainage Ditch on the National Grid property. The third area is along the northern boundary of Exposure Unit 4. c. The presence of uranium in groundwater along the west and northwest side of the IWCS will be further investigated and the results will be presented in the RIR Addendum (Section 4.0). d. Since the RIR was released, new information regarding the shape and extent of the groundwater plume southeast of the IWCS has been reviewed and this information suggests that the configuration of this plume may be overly conservative. The RIR Addendum (Section 4.0) will include a revised uranium groundwater plume map for this area that will correct the concentration of dissolved total uranium at the temporary well point (TWP833). This concentration in the center of the plume was misreported by the laboratory. The RIR Addendum will also remove manhole data since it is not representative of groundwater; and include more recent Environmental Surveillance Program data.

Number	Comments	Response
54	Department of Health Page 5-13 The fact that a former sellite manufacturing area was present should have been included in the discussion of whether sodium was a site related contaminant (and not just a nutrient). Sellite is sodium sulfite.	Sediment was sampled from manhole MH29, located in Exposure Unit 2 southwest of the former sellite plant (RIR, Section 5.2.1.5.). Sodium in manhole sediments ranged from 147 mg/kg at MH29 to 338 mg/kg at MH02. Sodium in Exposure Unit 2 soil ranged between 38.3 and 2,410 mg/kg. These results indicate that the concentration of sodium in the vicinity of the former sellite plant was not extraordinarily high. Because sodium is an essential human element that is commonly found in the environment and toxic only at very high doses, it is not likely to be hazardous to humans and was not considered a site-related constituent.
55	Department of Health Page 5-19 The presence of slag or gravel (around pipelines) and the resulting groundwater infiltration that inhibited further excavation indicates the importance of either natural or manmade deposits of coarse grained materials as groundwater pathways which could affect the migration of groundwater and contamination in a non-uniform manner.	The Corps concurs that porous bedding material, such as sand or gravel, would enhance the likelihood that pipelines would act as preferential pathways for contaminant migration. However, during pipeline construction, pipeline trenches were most often backfilled with native material and no porous bedding material was observed around pipelines leaving the NFSS. This is documented in the LOOW Underground Utilities Remedial Investigation Report (EA Engineering, Science, and Technology, Inc. [EA ES&T] 2008) available on the internet at: http://www.lrb.usace.army.mil/derpfuds/loow/index.htm. Furthermore, the groundwater plume maps, conservatively drawn for the NFSS, assumed that pipeline contents were in direct contact with groundwater, which accounts for the linear plume drawn southeast of the IWCS. This conservative approach is being revisited in select areas of the site where groundwater plumes will be delineated using only well and well point data (RIR Addendum, Section 4.0).

Number	Comments	Response
56	Department of Health Page 5-20 The presence of enriched uranium at a depth of 5.5 feet should be further investigated. The implications that such material is a) present and b) could have migrated or been buried to that depth is significant as it represents a different class of nuclear waste than typically associated with this site.	The sample in question was collected from exploratory Trench 414 excavated in Exposure Unit 4 (RIR, Section 5.3.1.1). The sample was collected from the wet ash-like material at a depth of 5.5 feet. To explore the possibility of enriched uranium contamination at the NFSS, a total of 147 isotopic uranium results were evaluated, all with detected uranium-234 concentrations above 2 pCi/g. Inspection of the uranium enrichment probability plot and histogram, presented in Section 5.9.4.4 of the RIR, shows that the remaining results can be interpreted as being within the normal range for un-enriched uranium. Attempts were made to tie this single result with historical activities. It was noted, however, that the total activity is relatively small compared to what might be expected for enriched uranium contamination and the result represents only about 0.7% of the entire data set.
57	Department of Health Section 5.3.1.4 The figures summarizing the occurrence of site-related constituents in groundwater are Figures 4-18 and 4-19, not as shown.	Typographic error is noted, however, this revision has no substantive impact on the conclusion of RIR.
58	Department of Health Page 5-21 The presence of elevated manganese or iron in groundwater does not need to be justified by the presence of elevated manganese or iron in soil. Reductive dissolution of iron and manganese from soil is a common process that can cause elevated manganese and iron in groundwater. The manganese plume is poorly defined since it is defined by only two locations (Fig 5-5). A more likely explanation that should be investigated is the potential presence of organic matter in the subsurface soils, or released organic compounds.	It is agreed that the presence of organic matter could promote reducing soil conditions favoring reductive dissolution of iron and manganese from soil which might be the source of manganese detected in Exposure Unit 3 groundwater. It is also agreed that the manganese plume in Exposure Unit 3 groundwater is poorly defined by just two locations (RIR, Section 5.3.1.4). The dissolution/solubility of iron and manganese increase with declining redox potential, as is normally seen in areas where plumes of volatile organic compounds are undergoing reductive dechlorination or the ambient groundwater is teetering on the oxic/anoxic line. Redox potential is a measure of the tendency of a chemical species to acquire electrons and thereby be reduced and form a new chemical species. The increased solubility and presence in groundwater of these two metals will trail behind the loss of nitrate converting to low-solubility nitrite, which leads to lesser nitrate in the groundwater (an indicator of the onset of reducing conditions).

Number	Comments	Response
59	Department of Health Figures 5-8 to 5-12 show groundwater plumes for chlorinated ethenes and vinyl chloride. The compounds are part of the degradation chain of tetrachloroethane which occurs under reducing conditions in groundwater. The presence of methane in groundwater at MW 415A confirms that reducing conditions exist. The plume isopleths as drawn are merely interpretations as there is insufficient delineation of the plume to be confident of its extent. However, of more important significance for these volatile organic compound plumes is that the dissolved concentrations are at a level indicating the potential presence of a tetrachloroethene (PCE) fluid in the subsurface. Tetrachloroethane, a chlorinated solvent, behaves as a dense non-aqueous phase liquid in groundwater and the observed concentration of 103.3 mg/L is approaching 50 % of the solubility of PCE in water. The likely presence of a dense non-aqueous phase liquid L source and dissolved plume should be further investigated in both the upper water-bearing zone and, because it is a dense non-aqueous phase liquid, the lower water-bearing zone as well. Contrary to the fate and transport modeling discussed in section 7.3.4, the modeling only addresses dissolved phases and does not account for dense non-aqueous phase liquid transport.	Concur; the groundwater modeling addresses tetrachloroethene and other volatile organic compounds within Exposure Unit 4 in the dissolved phase only. Further investigation of this contamination in both the dissolved and dense non-aqueous phase liquid forms was conducted in the fall of 2009 and will be reported in the RIR Addendum (Section 4.3). Additional groundwater and soil sampling was completed in Exposure Unit 4, near the vicinity of monitoring well MW415A, to better define the extent of the dense non-aqueous phase liquid source and degradation-product plumes. The results of this investigation will be presented in the RIR Addendum (Section 4.3). There are no plans for lower water bearing zone wells for this area, as it is believed that the Glacio-Lacustrine clay layer is acting to restrict contaminate movement, both dissolved and dense non-aqueous phase liquid. The RIR identified tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride groundwater plumes in Exposure Unit 4 at a depth of approximately 10 to 15 ft bgs where tetrachloroethene and trichloroethene (dense non-aqueous phase liquids) sources may exist (RIR, Section 5.3.1.4). Groundwater modeling results indicate that only minor dispersion of this volatile organic compound plume occurs due to low soil permeability (Groundwater Model, Section 4.5). As biodegradation occurs, tetrachloroethene and trichloroethene concentrations gradually decline, while degradation products (cis-1,2-dichloroethene and vinyl chloride) increase slightly in the first 50 years (Groundwater Model, Section 4.4.3). Tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride are all expected to degrade to levels less than the screening values within 300 years in the Brown Clay Till. The modeling then shows these volatile organic compounds migrating downward into the Glacio-Lacustrine clay. Trichloroethene and vinyl chloride further migrate to the Alluvial Sand and Gravel and Queenston Formation in the first 150 years. Vinyl chloride is predicted to degrade to below screening levels within 200 years.

Number	Comments	Response
60	Department of Health Page 5-26 The compound 1,1,2-TCE is likely meant to be 1,1,2-TCA (i.e. trichloroethene).	Noted, the text should read 1,1,2-trichloroethane. This typographical error is acknowledged but does not substantially change our understanding of contamination in Exposure Unit 4.
61	Department of Health Page 5-35 Since the lone subsurface soil sample exceeded background upper tolerance limits (UTLs) for radiological parameters, this indicates the need for further delineation at depth.	Soil boring SB314-415 was the lone subsurface soil sample collected during Phase 2 sampling in Exposure Unit 8; however, additional subsurface soil samples for delineation were collected during Phase 3 sampling activities. Analytical results for all RI samples can be found in Appendix AA of the RIR.
62	Department of Health Page 5-38 The detection of RDX should be further investigated.	Given that an extensive soil sampling has been conducted at the NFSS and the fact that this was a low detection and the only detection of RDX (aka Cyclotrimethylenetrinitramine, an explosive widely used in military and industrial applications) on site, the Corps believes that no further investigation for RDX is warranted(RIR, Section 5.5.1.4).

Number	Comments	Response
63	Department of Health Page 5-49 The significance of cesium-137 in groundwater appears to have been minimized since it was observed in wells below the derived maximum contaminant level (MCL). However, what is not addressed is that cesium-137, a radiogenic isotope often associated with atmospheric fallout or nuclear fission and the KAPL waste was found in groundwater. If the cesium-137 came from atmospheric fallout (perhaps Chernobyl in 1986?) and recharged to groundwater, then it usefulness as a tracer may be important. Otherwise the presence of fission products at NFSS must be assumed.	Cesium-137 is a fission product with global distribution due to fallout from atmospheric testing of nuclear weapons; however, the concentrations of cesium-137 found at NFSS are higher than regional background and greater at depth than in surface soil (RIR, Section 5.6.1). Thus, the concentrations and locations of cesium-137 at the NFSS are not consistent with what would be expected from atmospheric fallout. Therefore, the KAPL waste is assumed to be the source of the cesium-137 contamination; however, the widespread nature of the contamination is being investigated. Although historic documents provide some information about where fission product contaminated materials were stored on-site, it is not known with certainty if the materials remained solely in those identified locations. Although the exact source(s) of cesium-137 are not clear, potential risks due to exposure to cesium-137 were quantified by the Baseline Risk Assessment. Cesium-137 was identified as a radionuclide of concern in several Exposure Units and will be further assessed during the FS. All the significant cesium-137 detections in groundwater were from unfiltered samples, whereas only one filtered groundwater sample, GW 103-746-000909, showed cesium-137 in a detectable amount of 2.61 pCi/L (a corresponding unfiltered value of 2.07 pCi/L was flagged as unusable). Unfiltered groundwater samples collected during the RI generally had high turbidity, or suspended solids. The cesium detected in unfiltered samples may not be dissolved, but suspended, making it less of a concern for offsite migration.
64	Department of Health Page 5-50 Actually, higher dissolved oxygen in MH09 would be more conducive to greater solubility and mobility of uranium, contrary to what is stated in the text. The statement in the text should be clarified.	A statement on page 5-50 reads: "The water in manhole MH09 had higher conductivity, DO and pH than the other manholes in this area (RIR, Section 5.6.15). These differences in water chemistry may be suppressing the solubility of uranium compounds in MH09 ." This statement may be incorrect but does not substantially change our understanding of contamination in manhole water in the vicinity of the IWCS.

Number	Comments	Response
65	Department of Health Page 5-52 It is noted that there is a lack of soil samples collected to evaluate the high gamma areas noted. This should be investigated further.	Soil samples collected during Phase 3 were selected based on elevated readings detected during the gamma walkover since there appears to be a correlation between some of the elevated gamma readings and the detection of radionuclides in soil (RIR, Section 5.6.1). Small areas of high gamma walkover readings were observed in the vicinity of the former organic burial area and along the O Street South Ditch west of the Central Ditch in Exposure Unit 7. Several soil samples collected in these areas exhibited elevated levels of radium-226 and thorium-230. However, no soil samples appear to have been taken near elevated gamma readings identified northwest of the IWCS, along the east side of the IWCS and in the southeast corner of Exposure Unit 10. The highest gamma walkover readings within Exposure Unit 11 were directly northwest of former Building 403 and the Hittman Building. The RIR Addendum will include additional investigation of soil and groundwater northwest of the IWCS, however, no additional investigation is planned for east side of the IWCS or near the Hittman building. Results of the additional investigation will be included in the RIR Addendum (Section 3.4).
66	Department of Health Page 5-53 Exposure Unit 12 may be wooded now, but photographs from the 1940's suggest that most land in this area had been cleared. Can it be confirmed that this area remained wooded and had no activity for the duration of the past 65 years?	Based on a historical document and photo review, no significant historic operations are known to have taken place in Exposure Unit 12. It cannot be confirmed that this area has remained wooded throughout the past 65 years; however, prior to 1942, all or some of the site was used for agricultural production which also would have required tree clearing.
67	Department of Health Page 5-61 The presence of plutonium-239 in the floor of Building 401 is significant as it confirms the presence of Knolls Atomic Power Laboratories (KAPL) waste and fission products at NFSS.	Concur. Building 401 was identified in the RIR as an area where Knolls Atomic Power Laboratories (KAPL) wastes were stored (RIR, Section 5.7, USACE 2007a).

Number	Comments	Response
68	Department of Health Page 5-63 The presence of americium-241 in West Drainage Ditch surface water is significant. It appears that americium-241 should have been part of the analytical program for surface water at NFSS.	The conclusion of the site-wide evaluation of transuranic and fission product data is that americium-241 is not a radionuclide of concern at the NFSS (RIR, Section 5.9.4.1). This conclusion was based on the low frequency of detection, as well as low detected concentrations. Americium-241 was detected in 9 out of 768 soil and sediment samples with minimum and maximum detected values of 0.0301 pCi/g and 0.636 pCi/g, respectively. Americium-241 is typically quite insoluble and adheres very strongly to soil and sediment; therefore, it would be most expected to be found in this environmental media. The concentration of dissolved americium-241 in surface water sample SW920-2122 was 16. 9pCi/L. However, the uncertainty associated with this result, as reported by the laboratory, was nearly as high, 15.2 pCi/L, and confidence in this result and the significance of this finding are low. Americium-241 was analyzed for in a total of 48 surface water samples collected from ditches and from within pipelines across the site. Americium-241 was not detected in any other surface water samples.

Number	Comments	Response
69	Department of Health Page 5-64 It appears to be a reasonable conclusion that historical operations on NFSS property have caused the impact by metals and radionuclides on the National Grid property (formerly referred to as the Niagara Mohawk property).	Concur. However, the presence of site-related constituents in Exposure Unit 9 environmental media is likely the result of historical operations. Based on sampling conducted in Exposure Units 9 and 10, it appears that contaminated surface soil and erosion from the R-10 pile formerly located in Exposure Unit 10, could have been a potential historical source of constituents detected in sediment and surface water in the West Drainage Ditch in Exposure Unit 9. Recent Environmental Surveillance Program sampling in the West Drainage Ditch on the National Grid property (Exposure Unit 9) has not replicated the elevated uranium values seen during the RI (RIR Addendum, Sections 4.5 and 9.2.5, USACE 2010). Environmental Surveillance Program values are ten times, or more, below RI values. Historical surface water runoff and wind erosion likely contributed to migration of contaminants to the west and increased turbidity in the surface water samples and skewed the RI data upward; no filtered samples were collected, nor were metals analyzed for comparative purposes. Nearby groundwater plumes (between the IWCS and Exposure Unit 9) are also likely artifacts of the R-10 pile runoff into this plateau area during the 1960s to early 1970s, which can be seen as soil staining on aerial photos from that period (RIR Addendum, Section 5.4). Additional soil and groundwater sampling was conducted in late 2009 as part of the RIR Addendum activities. This sampling included soil and groundwater samples from the National Grid property which were analyzed for both chemical and radiological parameters to investigate the possibility of off-site contaminant migration via groundwater. The results of this investigation will be included in the RIR Addendum (Sections 3.0 and 4.0).

Number	Comments	Response
70	Department of Health Section 5.9 The evaluation of transuranic and fission product data raises several points for discussion. The Corps created strip charts for amercium-241, cesium-137 and enriched uranium and identified “outliers.” It then intends go back to the sampled locations and determine the reason for the “outlier” status. This methodology is completely backwards. The preferred and more systematic approach by the Environmental Protection Agency, Nuclear Regulatory Commission (NRC) and Department of Energy under MARSSIM is to start from the historical record, to determine which parts of the NFSS site are likely to be contaminated, which parts may be contaminated and which parts had no contamination. Parts of the site that were likely contaminated would be thoroughly examined, the number of samples and the gamma survey determined to give a statistically significant result. Areas with no contamination would be explored in a more cursory fashion. In this way, the Corps would home in immediately on problem areas. The absence of americium-241 does not imply the absence of transuranics, such as plutonium-239. This again depends on a review of the historical records. Since the waste from Schenectady was due to separation of plutonium from the waste materials, one does not expect to have a correlation. Americium-241 would generally follow the high-level waste and, to a lesser extent, the uranium product stream. Americium-241 decays to neptunium-237, not plutonium-239.	A systematic approach for data collection was used for the NFSS RI beginning with a review of historical documentation to identify and organize existing site data. Next, three phases of intensive environmental sampling and analyses were conducted starting with site-wide comprehensive sampling and narrowing to answer specific questions. A site-wide gamma-walkover survey was done to map the presence of surficial gamma-emitting radionuclides (RIR, Section 3.5). Environmental sampling of soil, surface water and sediment and a background gamma walkover survey of the Lewiston-Porter school campus were also performed to establish a baseline representing non-impacted areas in the local community (RIR, Section 3.0). Environmental sampling was systematic and biased toward areas where contamination was more likely to be present. Americium-241 is a by-product of plutonium production activities and results from the successive capture of neutrons by uranium and plutonium, so a correlation between the presence of plutonium and americium-241 is plausible. As noted in this comment, americium-241 and plutonium would likely have been largely separated during processing activities at KAPL. Also, while plutonium-239 decays to neptunium-237, it should be further noted that plutonium-241 is the parent radionuclide of americium-241. That is, plutonium-241 decays by emitting a beta particle with a half-life of about 14 years to become americium-241. Hence, it is reasonable to expect that plutonium could be collocated with americium-241 at the site.

Number	Comments	Response
71	Department of Health Page 5-74 The conclusion that the previous remediation of the West Drainage Ditch was incomplete appears correct. Transport of contaminated sediment should be investigated further.	Concur. To address the uncertainty associated with the uranium plume west of the IWCS, three new surface water and sediment locations in the West Drainage Ditch (Exposure Unit 9) were added to the Environmental Surveillance Program in October 2008. As part of the Environmental Surveillance Program, these locations will be sampled biannually and the results reported in the annual Environmental Surveillance Technical Memorandum. A discussion of the results up to date will be included in the RIR Addendum (Sections 4.5 and 9.0). Additional investigation of the total uranium groundwater plume located west of the IWCS is planned as part of the RIR Addendum (Section 4.5). The objective of this investigation is to define the off-site extent of the total/dissolved uranium plume in groundwater west of the IWCS and east of the West Drainage Ditch and to determine the potential for interaction from groundwater to surface water in the West Drainage Ditch.

Number	Comments	Response
72	Department of Health Page 5-76 The presence of radiological and other site-related constituents in the lower water-bearing zone is significant by itself and whether or not it exceeds its upper tolerance limit (of background) is important with respect to exposure. However, the fact that it is present in the lower aquifer suggests that explanations of how it got there as it is contrary to expectations based on information in the RI.	Several site-related dissolved metals were identified in the lower water-bearing zone at concentrations less than 2 and 5 times their respective background levels. Site-related dissolved radiological constituents (thorium-228, thorium-230, and radium-228) were identified in four wells at concentrations less than 1.5 times their respective background levels. These metals and radionuclides are naturally-occurring substances so their presence in groundwater at the levels identified is not surprising, nor is it necessarily related to site operations. In addition, due to its presence and mobility, uranium is the common site indicator for radiological transport of contamination in groundwater. The lower water-bearing zone exhibited relatively high isotopic uranium values (when evaluated against the overall lower water-bearing zone data set) in wells BH48, A57, and OW03A, although the results generally coincide with background levels and natural uranium-234 to uranium-238 ratios near or greater than a background threshold of 1.2 (i.e., ratios of 1.52, 1.14, and 1.37 respectively). It should be noted that these higher isotopic uranium values detected in the lower water-bearing zone wells were from unfiltered samples, and that dissolved data are more indicative of transportable constituents. Corresponding dissolved results were either lower than the total fraction results or had results below detectible limits.

Number	Comments	Response
73	Department of Health Page 5-77 Ballast by the rail road tracks has a correlation with radium-226. The Corps appears to believe it is due to slag. Another possibility is that the contamination is due to loading and unloading of railroad cars. Again, the historical record and sample locations should shed light on this issue.	The Corps agrees that another possibility for radium in railroad ballast is contamination due to the loading and unloading of railroad cars. The review of historic records has not been definitive as to the elevated radium found in surface soils and railroad beds. However, the use of phosphate slag containing significant quantities of Naturally Occurring Radiological Materials (NORM), including radium-226, for rail road ballast and general construction aggregate is widespread across the Niagara region. The Department of Energy investigated areas of elevated radioactivity in Niagara County and found slag with elevated radioactivity present at 62 locations within the county. This was determined to be a phosphate slag material previously identified as cyclowollastonite. This slag material is attributed to the electrochemical production of elemental phosphorus using uranium-bearing raw materials which reportedly originated from the former Oldbury Furnace in Niagara Falls (see the Department of Energy "*Results of Radiological Measurements Taken in the Niagara Falls, New York, Area (NF002), November 1986*"). A data summary for railroad ballast and building and road core samples is provided in Table 4.2 of the RIR. The RIR Addendum will include a comparison of these samples to surface soil background levels and risk-based limits appropriate for soil exposures (RIR Addendum, Section 8.0).

Number	Comments	Response
74	Department of Health The half-lives presented in Tables 6-1 to 6-3 are not site-specific rates of degradation. Many organic compounds degrade in the environment, however, most processes are microbially-mediated and appropriate environmental conditions must be present and maintained for the degradation to occur. For example, there are important differences between degradation rate of a compound in surface water (exposed to oxygen and sunlight) compared to groundwater where conditions would be much different. Therefore if these tabulated values are to be used to infer degradation half-lives at NFSS, then only those half-lives that were determined under field and environmental conditions to be similar to NFSS should be considered. Rates derived from laboratory microcosm studies have only limited applicability to predicting degradation in the field. Similarly, distribution coefficients (Kd) are not necessarily transferable between sites, or laboratory and field. Therefore, results derived from use of these tabulated values should be considered very carefully as they are unlikely to represent true behavior at the NFSS.	Concur. As pointed out in the comment, microbial-mediated degradation will only occur under the appropriate environmental conditions and these conditions must be maintained for the degradation to continue at a given rate. Since environmental conditions suitable for microbial-mediated degradation vary daily, seasonally and regionally, even half-lives determined under field and environmental conditions similar to NFSS would be rough estimates. The half-lives presented in Tables 6-1 through 6-3 are open literature values and are only presented as a qualitative indication of the relative rates of degradability for contaminants present at the NFSS. Similarly, Kd values for metals are from EPA Region IX or Oak Ridge National Laboratory (2001). A distribution coefficient, or K_d, is the ratio of the concentration of a substance in the aqueous or liquid phase, to the concentration bound to soil or in the solid phase. The K_d is used to model the mobility of a substance in groundwater. Site-specific degradation rates and the presence of degradation by-products may be investigated in the FS if this is important in the evaluation of potential remedial action alternatives.
75	Department of Health Page 6-2 The dismissal of acetone and 2-butanone as contaminants of concern due to "tendency to quickly degrade in the atmosphere and to biodegrade easily", and that they are potential laboratory contaminants appears unreasonable. The data was reviewed and verified as being valid. The fact that these compounds were detected decades after operations ceased at the site suggests that the assumption of rapid degradation and low migration concern are doubtful.	Acetone and butanone were not identified as constituents of concern by the Baseline Risk Assessment because they are generally present only slightly above background levels and potential risk due to exposure to these two compounds was below target risk levels. The compounds were not dismissed but were assessed and found to be present below their levels of concern (BRA, Section 2.0, USACE 2007b).

Number	Comments	Response
76	Department of Health Page 6-4 I disagree that a "complete understanding of the specific metal mobility and chemistry is beyond the scope of this RI". Knowledge of a contaminants site-specific fate and transport characteristics is precisely what the RI is intended to demonstrate.	Site-specific geochemical modeling (MINTEQA2) was performed to provide solubility variables and to understand the chemistry of the site chemicals of concern (Groundwater Model (Section 4.3.2, USACE 2007c). More geochemical modeling may be required during the FS to best determine appropriate remedial action strategies but a complete understanding of the highly complex, site-specific chemistry of metals detected in environmental media is not needed to delineate the nature and extent of existing contamination.
77	Department of Health Section 6.6 A RIR should contain a description of the site conceptual hydrogeologic model, and (this) is missing from this report.	A discussion of the site hydrogeologic model is included in Section 2.0 of the Groundwater Flow and Contaminant Transport Modeling report (which is referenced in the RIR) and is presented graphically in Figure 2.26 of the same report (USACE 2007c). The groundwater modeling report is available on the web at: http://www.lrb.usace.army.mil/fusrap/nfss/nfss-groundwatermodel-narrative-2007-12.pdf

Number	Comments	Response
78	The RI does not focus on the IWCS in proportion to the dominating concern for wastes inside and the potentials for their release. This deficiency calls into some doubt the process by which the Army Corps is remediating the NFSS.	The purpose of an RI is to assess fate, transport and risk posed by constituents of concern as they exist in their present concentration and location. The RIR concluded that unless the IWCS is opened and an exposure pathway created, there is negligible risk to human health posed by the IWCS in the near term. The levels of radioactivity inside the IWCS could pose more immediate threats to human health if the cap and cutoff walls were breached and people were directly exposed to radiological residues over the course of a few hours or days. During the RI, non-intrusive means were used to assess the integrity of the IWCS in its current state in order to maintain the protectiveness of the cover and cutoff walls, and to avoid potential risks to workers associated with intrusive sampling (RIR, Section 3.0 and RIR Addendum, Section 5.0). Also, sufficient information is available to complete the FS, so it was not necessary to perform such sampling. Information on the concentrations, volumes, and placement of residues and wastes in the IWCS is already well documented, so the NFSS RIR and Baseline Risk Assessment placed emphasis on risk arising from on-site contamination that is not confined within a protective barrier. The average levels of environmental contamination measured in media outside the IWCS, but within the NFSS, are much lower (about 10,000 times lower) than the average level of radioactivity inside the IWCS. The levels of contamination in environmental media on the site, but outside the IWCS, only have the potential to pose chronic risks to human health (such as an increase in cancer rates) if people occupy the site daily for decades.

Number	Comments	Response
79	If the RI Step of the NFSS project is itself inadequate, and corrections are relegated to long-term planning, the requisite long-term planning should be built explicitly into the project.	The RIR contains the information needed to proceed with the FS. The RI/FS process includes some degree of flexibility for characterizing the nature and extent of site contamination at CERCLA sites and for evaluating potential remedial options. Deciding how best to utilize this flexibility to conduct an efficient and effective RI/FS can sometimes represent a challenge. Although comprehensive investigation, sampling, and analysis of environmental media have been conducted for the NFSS, some data gaps are evident. When data gaps can be addressed using existing information, this will be done. Where needed, additional sampling or data collection will be conducted. Additional soil and groundwater sampling was conducted in late 2009 as part of the RIR Addendum activities (RIR Addendum, Section 3.0). Sampling focused on select areas of the site where plume delineation is needed or where there is a potential for off-site migration of contaminants via groundwater. The information needed to evaluate potential remedial action alternatives will be collected as part of FS effort, if needed, to support the comparative evaluation of alternatives and identify a preferred remedy. However, at some point, decisions must be made relying on the preponderance of evidence with full knowledge and acceptance of the uncertainties that may exist.

Number	Comments	Response
80	There is likely about as much strontium-90 as cesium-137 at the NFSS. Strontium-90 was not detected because its laboratory detection limits were set too high, about ten times as high as for cesium-137.	For the NFSS RI, strontium-90 analysis was performed for 2 groundwater samples, 31 soil samples, 11 sediment samples, and 6 surface water samples. Although the practical quantitation limit for strontium-90 was 2 pCi/g or 2 pCi/L, depending on the media, the average detection limit for all analyses was 0.74 pCi/g for solid media and 0.5 pCi/L for liquid media. These limits are not too high and are adequate to compare to screening levels: 1.7 pCi/g strontium-90 is the Nuclear Regulatory Commission's screening level for surface soils, and 2 pCi/L is the required regulatory detection limit for strontium-90, according to 40 CFR 141.25. While strontium-90 and cesium-137 are both fission products, produced in nearly equal amounts by nuclear fission, with nearly equal half-lives, the processing activities at KAPL could have altered the relative amounts of these two radionuclides in specific waste streams. Therefore, it is premature to conclude that there is likely about equal amounts of strontium-90 and cesium-137 at the site. Additional analyses for strontium-90 in groundwater have been conducted during recent Environmental Surveillance Program sampling events. This additional sampling was conducted at three wells selected because they previously had high recorded concentrations of cesium-137. The three wells sampled (OW11B, BH49A and 201A) had less than detectible levels (0.06 pCi/L) of strontium-90. The elevated levels of cesium-137 detected in groundwater during the NFSS RI may be due to high turbidity in the total-fraction samples. Subsequent groundwater sampling for strontium-90 and cesium-137 has not replicated the elevated RI levels. This data will be presented in the RIR Addendum (Section 9.0). Additional sampling for strontium-90 will be included in the investigations to be conducted in support of the RIR Addendum (Section 3.0).

Number	Comments	Response
81	The detection level for strontium-90 was about ten times too high to meet the requirements for an appropriate RI at the NFSS. The bottom-line remediation levels allow one excess cancer in a million, which is the risk accepted as default in the Risk Assessment Information System. For this default, the limiting pathway is ingestion of milk produced by cows feeding on vegetation contaminated with up to 0.064 pCi/g of strontium-90 in soil on the site. The preliminary remediation goal (PRG) would limit strontium-90 to no more than 0.064 pCi/g in soil. For a RI of a site like the NFSS to be adequate, the minimum detection level for strontium-90 in soil samples would then be chosen as some fraction of 0.064 pCi/g, enough less than 0.064 pCi/g to allow confidence in the remediation. A smaller fraction of this 0.064 pCi/g value would be selected if the actual remediation goal might be set more conservatively, such as a subsistence farming land use scenario. A larger fraction might be selected if the actual remediation goal were less conservative, such as some re residential or industrial land use scenarios. Stakeholders, regulators, and other decision makers would ordinarily be involved in selecting the target land use scenario and risk level for site remediation. Then the RAIS would allow a site-specific remediation goal for on-site contaminants such as strontium-90 in media such as soil.	As noted in this comment, a preliminary remedial goal for strontium-90 of 0.064 pCi/g was determined using a resident farmer scenario at the $1x10^{-6}$ cancer risk level with ingestion of milk produced by cows feeding on vegetation as the limiting pathway. This result is reasonable, but it should be noted that this scenario is highly unlikely at NFSS because the groundwater supply at the site that would be needed to water cattle is of naturally poor quality (highly mineralized) and wells are generally low yielding. It should be noted that the dose of natural background radiation accumulated over a lifetime presents a cancer risk estimated to be roughly 1 in 100 (EPA 2007). Also, the use of more realistic cleanup goals, such as an annual dose rate of 25 mrem/yr standard promulgated by the Nuclear Regulatory Commission in 10 CFR 20 Subpart E, would result in preliminary remediation goals that are well above the detection limits used for strontium-90 in the RI. An annual dose of 25 mrem/yr for a lifetime of 70 years would result in a cancer risk that is about 1,000 times higher than what was used in the evaluation summarized in this comment.

Number	Comments	Response
82	Some of the background sampling locations were probably contaminated with site-related materials, including fission product(s). This contamination of the study background raised the levels against which site contamination was measured. This possibility of site-related contamination of samples-collected-as background can be evaluated for the purpose of this review by separating the background soil sample locations for the RI into two categories, based on pre-LOOW land use at the background sampling locations. The Army Corps picked 16 locations outside the NFSS as representative of background for the NFSS, un-impacted by site-re related contaminants. Sample locations and rationales are described for each background location in Table 3-5 of the RIR. The description includes distance and direction from the NFSS and land use prior to establishment of the LOOW. For the purpose of this review, four of those 16 locations were selected on the basis of great distance from likely LOOW influence and land use that might discourage storage of LOOW-related materials, or other incidental LOOW uses. Table 3, on the next page, shows the four background locations designated for this review as more re-assured background:	Although the predominant radionuclides of potential concern at the NFSS include the naturally occurring uranium, thorium and actinium decay series, fission products and plutonium associated with past waste storage activities are also present at low concentrations (RIR, Section 5.9). Note that cesium-137 and strontium-90 exist at low levels across NFSS and around the world as a result of fallout from past atmospheric testing of nuclear weapons. Given the common occurrence of cesium-137 in environmental media, its occurrence in background samples is not unexpected. The calculation of descriptive statistics using four out of 15 (not 16 as noted in the comments) surface soil background locations selected as "more-assured background" based solely on distance from the site is not statistically defensible. One of the four locations selected (BK-1) did not include a surface soil sample and should not have been included in the data set. Regardless of the method used to determine site-specific background levels of cesium-137, it was listed as a site-related compound and potential risks from exposure were quantified by the Baseline Risk Assessment (Section 2.0). Cesium-137 was also identified as a radionuclide of concern for the most conservative receptor scenario assessed by the Baseline Risk Assessment (farm child) in several exposure units (BRA, Section 3.0). These areas of contamination will be further addressed during the FS.

Number	Comments	Response
82 (cont.)	B001 - 1,400 feet west of NFSS, unoccupied fore rest in LOOW buffer zone. B002 - 1,800 feet southwest of NFSS, an orchard rd in LOOW buffer zone. B013 - 16,000 feet west-northwest of NFSS, always a residential area. SBK1 - one mile west of NFSS, "not impacted by site-specific operations. Sample data from these four more-assured background locations were compared in Table 3 to the corresponding data from the other 12 locations, designated for this review as less-assured background Table 3 is interpreted by radionuclide, as follows: Cesium-137 - The arithmetic means of the more-assured and the less-assured background sample results, and their statistical uncertainties, in Table 3 are more-assured background: 0.070 ±0.012 pCi/g, less-assured background: 0.155 ±0.010 pCi/g. The mean cesium-137 in the less-assured background samples is a little more than twice the mean in the more-assured background samples. The mean of the less-assured background samples is 14 standard deviations of counting uncertainty above the mean of the more-assured background samples.	

Number	Comments	Response
83	The buffer zone of the old LOOW is evidently contaminated with site-related fission product(s). The activity of this background contamination is probably important for setting appropriate remediation goals for the NFSS.	The conclusion that the LOOW buffer area is contaminated with fission products released from the NFSS has not been demonstrated in a statistically defensible manner. This conclusion is based entirely on the "more-assured background" statistical analysis of cesium-137 data presented in Comment 82. In Comment 82, descriptive statistics for background, described as "more-assured background", were calculated using four out of 15 surface soil background locations selected as "more-assured" based solely on distance from the site. One of the four locations selected (BK-1) did not include a surface soil sample and should not have been included in the data set. This method is not statistically defensible. Regardless of the method used to determine site-specific background levels for cesium-137, it was listed as a site-related compound and potential risks from exposure were quantified by the Baseline Risk Assessment (Section 3.0). Cesium-137 was also identified as a radionuclide of concern for the most conservative receptor scenario assessed by the Baseline Risk Assessment (farm child) in several exposure units. These areas of contamination will be further addressed during the FS.

Number	Comments	Response
84	The RI fails to include radon emissions and airborne pathways. This failure needs correction.	Radon-222 concentrations in air have been measured at the IWCS perimeter and NFSS perimeter for many years. These concentrations have consistently been comparable to those for nearby background locations. In addition, the radon flux from the surface of the IWCS is monitored and this flux has always been well below the applicable standard of 20 pCi/m^2/s and representative of that for native soils in the area. These results are reported annually in the Environmental Surveillance Technical Memorandum. Radon-222 is a major concern for alternatives involving removal of the residues and wastes from the IWCS. However, current radon concentrations at the site are not elevated and not a significant concern for the remainder of the site, which was the focus of the RI. The presence of radon isotopes was addressed in the RIR in the reporting of information for the two parent radionuclides, radium-226 and radium-228 (Section 5.0). For the FS, the Corps will develop a Radon Assessment Technical Memorandum to assess potential exposure levels associated with radon gas and its short-lived breakdown products.

Number	Comments	Response
85	With fission products widespread at the NFSS, technetium-99 should be included as an analyte in the RI.	The Preliminary Remedial Goal (at Excess Lifetime Cancer Risk = 1E-6) for technetium-99 in residential soil is (96.3 pCi/g) approximately 4-fold higher than the residential soil Preliminary Remedial Goals for strontium-90 (11.7 pCi/g) or cesium-137 (23.4 pCi/g). Although the concentration for technetium-99 may not be an issue, it does have a low distribution coefficient (K_d) and therefore, low concentrations in soil could be a future groundwater issue. A distribution coefficient, or K_d, is the ratio of the concentration of a substance in the aqueous or liquid phase, to the concentration bound to soil or in the solid phase. The K_d is used to model the mobility of a substance in groundwater. Additional strontium-90, tritium and technetium-99 analysis has been conducted during recent Environmental Surveillance Program sampling events. None of these isotopes were detected in the wells that previously showed RI-based contamination. This data will be presented in the RIR Addendum (Section 9.0). Additional analysis for technetium-99 will be performed during future Environmental Surveillance Program sampling events.
86	Surficial groundwater (—the unconfined aquifer—) under the NFSS generally flows into the Central (Drainage) Ditch and leaves the site as surface water flowing northward in the ditch.	As noted in the RIR, several ditches onsite collect surface water runoff. Over most of the site, surface water is conveyed through east-west ditches that empty into the Central Drainage Ditch (See RIR Figure 2-1). The Central Drainage Ditch flows north and joins Four Mile Creek about 1.5 miles north of the NFSS. Surface water runoff from the western periphery of the site and from the Baker-Smith area in the northwest corner of the site flows to the West Drainage Ditch. The West Drainage Ditch flows north and joins the Central Drainage Ditch approximately 0.5 miles north of the NFSS. The hydraulic connection between surface water and the upper water-bearing zone was examined by the groundwater model (USACE 2007c). An evaluation of groundwater and surface water in the West Drainage Ditch and Central Drainage Ditch will also presented in RIR Addendum (Appendix 12-I).

Number	Comments	Response
87	Flows of surficial water in the area of interest are probably dominated by extended, lineal preferred pathways.	Agreed, drainage at the NFSS is poor because of the flat terrain and the relatively impermeable nature of surface soils. Much of the NFSS property has the potential to collect and hold standing water for lengthy periods. However, several ditches (lineal preferred pathways) onsite collect surface water runoff. In October 2008 the Environmental Surveillance Program was expanded to include biannual West Drainage Ditch surface water and sediment sampling at three locations, including a northern location where the ditch exits the NFSS in the Baker Smith area.
88	Interactions between groundwater and artificial lineal features on the NFSS should be evaluated in order to assess contaminant transport on and off of the site.	A prediction of water and solute discharge into four drainage ditches on the NFSS was conducted and a discussion of the model results will be included in the RIR Addendum (Appendix 12-I). The model was used to predict water and solute discharge into 4 drainage ditches on the NFSS: the Central, West, South 16 and South 31 Drainage Ditches. Salient results include: • Among the 4 drainage ditches, the highest average discharge rate was predicted for the Central Drainage Ditch. • The lowest discharge rate was predicted for the South 16 Drainage Ditch. • Of the four drainage ditches analyzed, the highest diluted uranium-238 concentrations are predicted to occur in the South 16 Drainage Ditch, originating from sources in Exposure Units 8, 11 and 12. • Uranium-238 screening level exceedances are predicted to occur in the South 16 and South 31 Drainage Ditches after 350 years. Screening level exceedances, based on diluted flow concentrations, are not predicted to occur in the Central or West Drainage Ditches. In addition to surface water and/or sediment samples regularly collected from the West, Central, South 31 and South 16 Drainage Ditches, as part of the Environmental Surveillance Program, the potential for an interconnection between groundwater and surface water in the West Drainage Ditch will be investigated as part of the RIR Addendum (Sections 4.5 and 9.0).

Number	Comments	Response
89	Problems with validation of data restrict the inferences that can be drawn from the analytical results of the RI.	All of the data used in the NFSS RIR were verified and/or validated. Please see RIR Appendices F and G which outline the quality assurance, quality control, and chemical data quality assurance report for the sampling results collected as part of the NFSS RI. These results are summarized in Sections 2.4.2 and 2.4.3 of the report.
90	There is no explicit basis within the RI to judge its overall validity and realism.	Section 2.4 of the RIR discusses the development and achievement of Data Quality Objectives for the NFSS. Data Quality Objectives are qualitative and quantitative statements that are used to develop a scientific and resource-effective sample collection plan. Data Quality Objectives were established during the NFSS Technical Project Planning meetings held during June 1999 and May 2000. They serve as formal documentation of the data quality requirements and indicate the overall validity of the process.
91	The RI generally does not satisfy the EPA Reviewer Checklist.	The EPA Reviewer Checklist is intended as a guide to assist the reviewer by identifying items that should not be overlooked. It is not meant to be prescriptive or binding. The results of a more direct review of the NFSS RIR by the EPA are available within this present document; all EPA comments are recorded and responses have been developed.

Number	Comments	Response
92	The Army Corps should have obtained a wider range of interests, viewpoints, and inputs into the remediation process in order to develop an adequate Sampling and Analysis Plan for the RI at the NFSS.	The Sampling and Analysis Plans are more than adequate for the site and were developed through the efforts of a large and diverse group of individuals. Prior to initiation of the Project Work Plans, the Corps Buffalo District held a Technical Project Planning Meeting, attended by approximately 20 individuals including Buffalo District personnel, representatives of the Corps Center of Expertise in Omaha, Nebraska, technical experts from various Corps of Engineers Districts and contractor and subcontractor representatives. Draft project work plans were reviewed by independent technical reviewers, including experts with no other project responsibilities. Two additional Technical Project Planning meetings have been held since where plans for development of Sampling and Analysis Plans for future project phases were discussed. Representatives of the Department of Energy, New York State Department of Environmental Conservation, New York Department of Health, Environmental Protection Agency, Region 2, the Corps Baltimore District, Modern Landfill, and former NFSS cleanup contractors provided opinions and or written comments concerning draft project plans. All of the comments and responses were integrated into the final sampling plans.

Number	Comments	Response
93	(EPA) The IWCS has a design life of 25-50 years. In 1984, DOE proposed a ten-year timeframe in which to review the integrity of the IWCS and to implement modifications as required. To date, approximately 26 years have elapsed. What are the Corps' plans for periodic review of the IWCS's integrity and for any modifications to the IWCS? Besides the geophysical surveys performed by the Corps to evaluate the integrity of the IWCS, is the Corps considering physical inspections of the IWCS barriers (e.g., via partial trenches) to evaluate the integrity and confirm the geophysical findings?	Through the completion of three phases of the RI (including a geophysical survey of the IWCS) and regular monitoring of radon levels near the IWCS as part of the ongoing Environmental Surveillance Program, it has been determined that the IWCS is not currently leaking and does not pose an immediate threat to human health and the environment near the NFSS. During the RI, non-intrusive means were used to assess the integrity of the IWCS in its current state in order to maintain the protectiveness of the cover and cutoff walls, and to avoid potential risks to workers associated with intrusive sampling (RIR, Section 3.0). Since sufficient information is available on the IWCS and its contents to complete the FS, there is no reason to expend additional resources to investigate this structure further at this time. The geophysical survey of the IWCS indicated no short-term competency issues (RIR, Appendix C). The Corps acknowledges that there are limitations associated with the survey geophysical techniques used, but these limitations were leveraged, to the extent possible, by using a variety of geophysical survey methods. The groundwater modeling results also serve to allay concerns that residues in the IWCS pose an imminent threat to groundwater quality on, or around, the NFSS. The model provides predictions of groundwater quality in areas where groundwater monitoring is difficult, if not impossible, such as below the IWCS. The predicted concentration of waste exiting the IWCS is very low and model results indicate that there is not an immediate threat to human health and groundwater quality. In fact for IWCS-based sources, property boundary exceedances are not predicted to occur within the first 1,000 years (Groundwater Model, Section 5.1).

Number	Comments	Response
93 (cont.)		The current status of the IWCS is monitored on an ongoing basis as part of the Environmental Surveillance Program. A description of the Environmental Surveillance Program sampling conducted to demonstrate near-term cap integrity will be included in the RIR Addendum along with additional information regarding the IWCS contents (RIR Addendum, Section 5.0). Enhancements made to the Environmental Surveillance Program in 2008 are described in a fact sheet available at: (http://www.lrb.usace.army.mil/fusrap/nfss/index.htm#EnvSurv).
94	(EPA) The groundwater radiological conditions and modeling should consider the total and dissolved phase of the radionuclides. Figures showing groundwater plumes of the total phase need to be included in the RIR.	For metal and radionuclide site-related constituents, both total and dissolved concentrations were used to assess the existence of groundwater plumes. However, only the dissolved concentrations were used to define the iso-concentrations used in the groundwater model that are presented in the RIR (Sections 5.1.2). This is partly due to the fact that RI groundwater samples were predominantly collected from temporary well points which, by nature, can exhibit high turbidity. Samples for dissolved analysis were filtered in the field at the time of collection, removing much of the turbidity. Dissolved concentrations were also used to define plumes during this RI because portions of a constituent in an unfiltered sample can be sorbed onto particulate matter rather than be dissolved in the groundwater. Hence, dissolved fractions of constituents are likely to be more mobile in groundwater than non-dissolved fractions (i.e., the brown clay till is not conducive to colloidal transport). However, it should be noted that the Baseline Risk Assessment evaluated dose and risk from exposure to total concentrations of constituents in groundwater to ensure a more conservative assessment of risk to human health and to comply with specifications included in Risk Assessment Guidance for Superfund (EPA 1989). Maps showing the locations of total phase radionuclides in groundwater were developed for use in discussions with EPA.

Number	Comments	Response
95	(EPA) The source of cesium-137 in groundwater is not well determined: possibly because of insufficient availability of historical information vis-à-vis site operations and waste handling. There may be a potential cesium-137 groundwater plume centered along/near the Central (Drainage) Ditch and extending from Exposure Unit 11 to Exposure Unit 2. The location, of this potential plume needs further evaluation. Also, further evaluation of plutonium-239 is recommended at least in areas containing cesium-137.	Although the source(s) of cesium-137 at the NFSS at specific locations are not known with certainty, it is important to keep in mind that cesium-137 is a fission product with global distribution due to fallout from atmospheric testing of nuclear weapons. Potential risks due to exposure to cesium-137 were quantified by the Baseline Risk Assessment and cesium-137 was identified as a radionuclide of concern in several exposure units (RIR, Section 7.0). The method used to evaluate the existence of fission products, including cesium-137, is described in Section 5.9 of the RIR. In subsequent groundwater sampling, cesium-137 has been below detection limits, which might indicate that the unfiltered groundwater samples used for the RI produced artificially elevated levels of cesium-137 due to sample turbidity. Additional groundwater sampling and analysis for cesium-137 is planned and the results will be presented in the RIR Addendum (Section 9.0).

Number	Comments	Response
96	(EPA) It seems that the objectives of the DOE previous remedial actions are less stringent than those of the Corps. This seems evident because the Corps remedial-investigations concluded the elevated levels of radioactivity still exist within the area previously remediated by DOE. As such, it is prudent that the Corps re-investigate vicinity properties. If this is not possible because of pre-existing agreements between the Corps and DOE at the time of FUSRAP responsibility transfer, then other means are needed to assure vicinity properties and any other off site areas potentially impacted from former operations of the LOOW site are properly remedied.	The Department of Energy did not remediate the Niagara Falls Storage Site or Vicinity Properties E, E' and G. These properties remain within the authorized scope of the Corps' NFSS Formerly Utilized Sites Remedial Action Program (FUSRAP) and will be thoroughly characterized and remediated by the Corps to meet cleanup criteria and obtain regulatory closure. The Department of Energy is responsible for determining the eligibility of a vicinity property for the FUSRAP. Following regulatory closure of a vicinity property by the Corps, the Department of Energy provides necessary long-term care as needed. The Department of Energy has responsibility for 23 completed vicinity properties near the NFSS. During a community workshop in December 2009 the Department of Energy discussed their intent to review land use and assess protectiveness at closed NFSS Vicinity Properties Q, R, X, S, T, and W (See http://www.lrb.usace.army.mil/derpfuds/loow/loow-ws-presentation-doe-2009-12.pdf). The Department of Energy explained that these properties were selected for re-evaluation because of questions raised by local citizens and because the properties are either accessible to the public or adjacent to NFSS drainage ditches. The Department of Energy recently completed “NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches” (DOE 2010), which reviews of all the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx. Public input or questions concerning all closed NFSS vicinity properties should be directed to Bob Darr, Public Affairs Specialist at (720)377-9672 or bob.darr@LM.doe.gov.

Number	Comments	Response
97	(EPA) Given the fact that radioactivity is still found in surface water and sediment samples, it is prudent that the Corps investigates off-site sediment and surface water bodies that could have been impacted by historical discharges, including the outfalls at Niagara River.	Exposure Unit 15 included on-site surface water and sediment in the main ditch system including Central Ditch, South 16 Ditch, South 31 Ditch and Modern Ditch. No radionuclides of concern were identified in surface water or sediments in these ditches. Based on RI sampling conducted in the West Drainage Ditch, it appears that contaminated surface soil on the NFSS could have been a potential source of radiological constituents detected in sediment and surface water in the West Drainage Ditch. Site clearing prior to RI sampling likely disturbed surface soil and sediment near the West Drainage Ditch and may have affected sample results (i.e., caused turbid water samples and sediment redistributions). Environmental Surveillance Program sampling of West Drainage Ditch sediment and surface water conducted after the RI was completed indicate lower levels of radiological constituents. The potential for the interconnection between groundwater and surface water in the West Drainage Ditch will be investigated as part of the RIR Addendum effort. Offsite radiological sampling of the West Drainage Ditch was conducted during the LOOW Phase IV RI (former LOOW Waste Water Treatment Plant). The results for this investigation will be forthcoming.

Number	Comments	Response
97 (cont.)		The Remedial Investigation of Underground Utilities completed for the LOOW investigated underground lines and outfalls and found that the deepest and most heavily chemically contaminated pipelines were the acid waste and sanitary sewer lines as they approach the wastewater treatment plant north of the NFSS (EA Engineering, Science, and Technology, Inc. [ES&T] November 2008). This report can be found at: http://www.lrb.usace.army.mil/derpfuds/loow/index.htm. One sanitary line and two acid waste lines extend off the NFSS to the north. All of these lines were sealed at the property boundary and the Remedial Investigation of Underground Utilities indicates that no bedding material, which could act as a preferential pathway for contaminant migration, was present around the pipelines leaving the NFSS (EA ES&T, November 2008). Sanitary sewer and acid waste lines are not to be confused with the main 42-inch water intake pipeline. Sanitary sewer and acid waste lines ran northward to the LOOW waste water treatment plant. At the waste water treatment plant, sanitary sewer water was combined with the TNT and acid process wastewaters. The combined wastewaters were then discharged to the Niagara River through two outfalls. The Remedial Investigation of Underground Utilities did document radiological contamination in these lines. The fact sheet that discusses the results of this investigation can be found at http://www.lrb.usace.army.mil/derpfuds/loow/loow-fs-uuri-2009-05.pdf.

Number	Comments	Response
98	(EPA) Groundwater modeling indicates that a groundwater plume is migrating off-site. As such, we recommend that off-site groundwater monitoring wells be installed and monitored along with on-site wells routinely in quarterly bases to account for seasonal variation, including the monitoring of private wells downgradient of NFSS.	Based upon RI findings, additional groundwater sampling is planned for three locations to better delineate potential off-site contaminant migration. The first area is northwest of the NFSS property where the uranium plume appears to cross the site boundary onto the Town of Lewiston property (former LOOW wastewater treatment plant). Off-site testing in this area is needed to define the extent of the uranium plume. The second area of interest concerns the potential for an interconnection between groundwater to the west of the IWCS and surface water in the West Drainage Ditch on the National Grid property. The third area is along the northern boundary of Exposure Unit 4. Additional groundwater sampling in these three areas of interest was conducted as part of the RIR Addendum field work. Results of this sampling will be presented in the RIR Addendum (Sections 3.0 and 4.0). The scope of the routine monitoring conducted for the Environmental Surveillance Program will be modified based on the findings from these three investigative areas.
99	(EPA) The presence of elevated levels of total radium-226 and radium-228 in groundwater is not fully addressed in the RIR. This needs to be addressed and plume maps provided showing data of total and dissolved phases.	A review of the dissolved concentration data for radium-228 and radium-226 shows no plumes present in the upper water-bearing zone. Total concentration data for radium-226 shows sporadic detections above background levels and no distinguishable plume. Total concentration data for radium-228 suggests the possibility of two groundwater plumes near the IWCS. However the radium-226 and radium-228 values are relatively low with few exceedances of the drinking water standard for these radionuclides (5 pCi/L for radium-226 and radium-228 combined). Radium-226 and radium-228 detection maps were developed and provided to the EPA. The groundwater plume figures were developed using soluble results to illustrate the worst case of groundwater movement and potential contaminant impacts.

Number	Comments	Response
100	(EPA) At times the Corps attempts to link the source of contamination found with previous site operations and storage of waste, while at other times the source of contamination in certain areas remains undetermined (e.g., the source of the groundwater uranium plumes on the north and west sides of the IWCS, the source of radium-226 and radium-228 in groundwater near the IWCS, the source of cesium-137 in certain exposure units, etc.). Can the source of the plumes near the IWCS be due to the materials stored inside the IWCS? Determining the source of the contaminants will provide a better understanding of the site conditions and consequently aid in the FS and remedial action phases.	The RI began with a records review in order to gain an understanding of historic site operations and how these operations may have contributed to potential contamination. Where possible, links were made between existing contamination and previous site operations. Following the records review, site reconnaissance was conducted to identify areas potentially impacted by site operations. Field activities were then conducted using a phased approach to refine the understanding of the nature and extent of contamination at the NFSS and their relationships to exposures, risks, and remedial alternatives. A description of the project approach is presented in Section 2.1 of the RIR Since the geophysical survey that was performed during the RI found the IWCS to be sound, it is believed that the groundwater plumes around the IWCS are associated with historic construction activities and remnant pipelines rather than emanating from the IWCS (RIR, Appendix C). The previously open R-10 storage pile located north of Bldg 411 was subject to leaching and erosion, which created groundwater plumes west and possibly north of the current IWCS (i.e., K-65 residue slurry treatment lagoons are proximal to the northern plume area). Former Building 409, whose foundation is currently located south of the IWCS, was a secondary water reservoir. Operations conducted at former Building 409, as well as the decontamination method used to remove the most obvious contamination prior to building demolition, may have contributed to the higher concentrations of radionuclides now evident in this area. The Corps believes that the groundwater plumes evident in this area were developed before the IWCS was constructed and were subsequently truncated by IWCS construction activities. The IWCS is currently believed to be adequately containing the contamination stored within the structure. Environmental Surveillance Data collected over the past 28 years supports this conclusion. Environmental Surveillance Program data do not indicate an increasing trend in uranium concentrations in groundwater wells near the IWCS that would be indicative of a breach. Instead, only seasonal fluctuation of uranium concentrations is noted, which is typical of other on-site wells near areas of past radioactive storage. Information supporting the integrity of the IWCS will be presented in the RIR Addendum (Section 5.0). Additional information regarding the IWCS contents and integrity will also be presented in Technical Memoranda to be prepared in support of the FS.

Number	Comments	Response
101	(EPA) The metals analyses method used to assess total-uranium seems to underestimate the total-uranium concentrations when the contaminant levels are elevated. As such, when metals analyses are performed to assess total-uranium (µg/L), the Corps should give consideration to also use the specific activities for each uranium isotope to obtain total uranium in µg/L and compare the results of both methods to identify any potential errors, overestimates, or underestimates.	Upon further evaluation, the Corps found that, on a site-wide basis, a close relationship exists between uranium concentrations estimated using the metals analytical method and uranium concentrations obtained using specific activities for each uranium isotope. As such, it is appropriate to use the total uranium concentrations using the metal analytical method to support remedial action decisions for the site.
102	(EPA) It is prudent that the Corps investigates off site areas that could have been impacted from historical discharges via run-off, pipelines, underground utilities, previous usage, and groundwater plumes.	During the RI, surface water samples were collected from Exposure Units 7, 10, and 11 in Phases 1 and 3 to assess runoff from the IWCS, the organic burial area, and the storm-water ponds. Additional investigation of the total uranium groundwater plume located west of the IWCS is planned as part of the RIR Addendum, including areas on the National Grid property (Exposure Unit 9). The objective of this investigation is to define the off-site extent of the total/dissolved uranium plume in groundwater west of the IWCS and east of the West Drainage Ditch, and to determine the potential for interaction from groundwater to surface water in the West Drainage Ditch. The results of this investigation will be presented in the RIR Addendum (Sections 4.0 and 9.0). The Corps collected offsite radiological samples from the West Drainage Ditch during the LOOW Phase IV Remedial Investigation (former LOOW wastewater treatment plant). This data will be forthcoming. The LOOW Underground Utilities Remedial Investigation (EA, ES&T, 2008) contains additional data on the presence, fate and transport of contaminants in the former LOOW pipelines, including the acid waste and sanitary sewer lines that run offsite from the NFSS. Radiological sampling of the pipelines will be analyzed in the RIR Addendum (Section 10.0).

Number	Comments	Response
103	(EPA) Given that fact that the Corps still needs to re-investigate vicinity properties (e.g., groundwater, private wells, surface water, sediment, outfalls, underground utilities etc.) and address potential on-site data gaps (e.g., contaminants in groundwater and possibly intrusive inspection of the IWCS), the Corps should evaluate the new findings and determine the need for revising the Baseline and Ecological Risk Assessments and groundwater modeling.	An RIR Addendum will be prepared to address any data gaps that may affect the evaluation of alternatives in the FS. Limited additional sampling may be conducted to eliminate specific RI data gaps. However, unless new findings deviate substantially from what is already known based on the current data set, revisions to the Baseline Risk Assessment, the Screening-Level Ecological Risk Assessment (SLERA) and the Groundwater Fate and Contaminant Transport Model will not be performed, as they have met the RI-based Data Quality Objectives for this CERCLA phase.
104	(EPA) EPA believes that the groundwater investigations performed by the Corps to date, especially in the UWBZ are interim investigations to gain some understanding of the contaminant conditions in groundwater. EPA anticipates that the Corps will fully address the final groundwater conditions, on-site and off-site, after the removal of contaminant sources in surface and subsurface soil, underground utilities, and other structures.	The Corps will fully address the final groundwater conditions, on-site and off-site, after any necessary remedial actions at the site are completed, i.e., the removal of contaminant sources in surface and subsurface soil, underground utilities, and other structures. Groundwater currently monitored as part of the Environmental Surveillance Program and additional groundwater investigation is planned to explore the potential off-site migration of contaminated groundwater and to delineate the nature and extent of groundwater contamination. Results of additional investigative activities will be presented in the RIR Addendum (Section 4.0) The results of Environmental Surveillance Program monitoring are reported annual in the Environmental Surveillance Technical Memorandum available on the internet at: http://www.lrb.usace.army.mil/fusrap/nfss/index.htm. The Corps plans to address the need for groundwater remedial action in a separate Proposed Plan, after remedial action decisions have been made regarding the IWCS and the Balance of Plant soils and other solid media.

Number	Comments	Response
105	(EPA) Section ES.4, Page xxxv, Site Description: The text indicates that "the surrounding area land use consists primarily of row-crops and orchards, abandoned agricultural fields, and second-growth forests". This appears to be inaccurate as there is considerable public interest in the NFSS, particularly because the NFSS is near a growing population. Although Figure 1-7 shows the surrounding land use, it doesn't show where individual residences are located. Consistent with this comment, it can be noted that the greenery that appears toward the east and north of the site in Figure 1-12, consists of the Modern Landfill and CWM properties. Perhaps a tax map could be provided which would show the density of residential properties within the private land shown on Figure 1-7.	The description of the regional land use reflects current conditions, but it is noted that regional land use does fluctuate over time. Current zoning maps may be included in the FS; however, a tax map that identifies individual property owners is even more susceptible to change and could be considered an invasion of privacy. Regional population trends for Niagara County show a 1.7% decline from 2000 to 2006,.although the area immediately surrounding the NFSS property appears to be stable (i.e., no significant rezoning or residential pressures). A Future Land Use Checklist is being prepared for the entire former Lake Ontario Ordnance Works which will identify residential areas surrounding the NFSS.
106	(EPA) Section ES.5, Page xxxvii, Exposure Unit 3 and Exposure Unit 4. Acid Area and Vicinity: Were the acids only used in support of the TNT operations or were they also used in radiological operations such as pickling of nuclear fuel?	Specific information concerning the use of acids in this area is not known with certainty, but the Corps believes the acid lines were specifically used only for LOOW TNT operations. There is no indication that acids were used in any processing activities involving radioactive wastes such as spent nuclear fuel. The LOOW Completion Report (White Engineering 1943) will be included in the RIR Addendum to provide additional information (RIR Addendum, Appendix 12-B).
107	(EPA) Section ES.7: Did the BRA include the toxicity risk from the uranium isotopes? If not, then the toxicity risk assessment should be included.	The Baseline Risk Assessment looked at the chemical toxicity of uranium independent of its radiological carcinogenicity. Assessment of the non-carcinogenic (chemical toxicity) properties of uranium is found in Section 2 of the Baseline Risk Assessment.

Number	Comments	Response
108	(EPA) Section ES.7, Page xlvi, 1st paragraph. The risk to the subsistence farmer from pipeline and subsurface utilities assumes limited exposure time. This may change in the future scenario should contaminants within such utilities be relocated in the future due to construction or disturbance of such lines. Therefore, exposure of subsistence farmer to contaminants identified in such utilities may need to be considered.	The decision not to assess subsistence farmer exposure to pipeline contents was based on the assumption that exposure to pipelines is more likely to be a short-term exposure during removal of the lines rather than an on-going exposure. Also, pipelines closer to ground surface with the greater likelihood for direct exposure are the cleaner potable lines rather than the more contaminated sanitary and acid waste lines. Site-specific remedial goals established during the FS will address short-term exposure to pipeline contents by a resident gardener as well as ingestion of local deer meat.
109	(EPA) Section: ES.7, Page xlvi 1st paragraph: Even when contaminants in groundwater may meet the human health risk criteria, the Corps should address the presence of contaminants in groundwater to meet the MCLs set forth in the Safe Drinking Water Act.	The need for remedial action at NFSS will be fully evaluated in the FS. The FS will draw upon the Baseline Risk Assessment and also will consider Applicable or Relevant and Appropriate Requirements (ARARs) such as the Safe Drinking Water Act and other federal or state policies, guidelines, or rules developed to address potential risks at sites such as NFSS.

Number	Comments	Response
110	(EPA) Section ES.9, Paragraph xlvii, 2nd paragraph: It is unclear why groundwater samples were not collected from Exposure Unit 9. Please explain given that there is a groundwater plume near the western boundary of Exposure Unit 7 that abuts the eastern boundary of Exposure Unit 9 and that radiological contamination was found on the banks of the West Ditch that is located in Exposure Unit 9. Future groundwater sampling in Exposure Unit 9 should be considered.	No monitoring wells were installed in Exposure Unit 9 due to restricted property access. To address the uncertainty associated with the uranium plume west of the IWCS, three new surface water and sediment locations in the West Drainage Ditch were added to the Environmental Surveillance Program in October 2008. The results from these new surface water and sediment locations in the West Drainage Ditch showed non-detectable levels of radionuclides. The results of this analysis will be reported in the RIR Addendum (Sections 4.5 and 9.0). The RIR Addendum will also include the results from additional monitoring wells to be installed in this area to explore the potential for an interconnection between groundwater west of the IWCS and surface water in the West Drainage Ditch (RIR Addendum, Sections 3.0 and 4.5). It should be noted that the concentrations of dissolved total uranium and other radioactive isotopes detected in Exposure Units 7 and 10 groundwater decrease moving west away from the IWCS. The concentrations of total uranium and other radioactive isotopes detected in several wells and temporary well points located along the western boundaries of Exposure Units 7 and 10 are in the lower end of the background levels bounding the plume to the west. Furthermore, the concentrations of total uranium measured in West Drainage Ditch surface water are variable along the ditch suggesting that the uranium may have come from several sources rather than a single discrete source such as a groundwater seep (which would have to have been an extremely contaminated seep to produce the surface water concentrations seen during the RI). Also, the R-10 storage pile of radioactive materials was previously left uncovered and unprotected in this area for a number of years. Wind erosion and surface water runoff appeared to have contributed to contaminant migration. The R-10 pile is now contained within the IWCS and, since the RIR was completed, consistently decreasing concentrations of uranium have been measured in West Drainage Ditch surface water (RIR Addendum, Sections 4.5 and 9.0).

Number	Comments	Response
111	(EPA) Section 1.5, Page 1-4, 2nd paragraph: The paragraph states, in part, "Radioactively contaminated soil from a vicinity property was excavated and placed on the R-10 pile in 1981. "The DOE remedial objectives of 1981 may not meet the current Corps objectives that are set to meet CERCLA standards. As such, the RIR needs to specify which vicinity property is referred to in this paragraph and the Corps should consider revisiting such property, re-assess the radiological conditions, and take the necessary actions to ensure the protection of the public health and the environment.	The Department of Energy did not remediate the Niagara Falls Storage Site or Vicinity Properties E, E' and G. These properties remain within the authorized scope of the Corps' NFSS Formerly Utilized Sites Remedial Action Program (FUSRAP) and will be thoroughly characterized and remediated by the Corps to meet cleanup criteria and obtain regulatory closure. The Department of Energy is responsible for determining the eligibility of a vicinity property for the FUSRAP. Following regulatory closure of a vicinity property by the Corps, the Department of Energy provides necessary long-term care as needed. The Department of Energy has responsibility for 23 completed vicinity properties near the NFSS. During a community workshop in December 2009 the Department of Energy discussed their intent to review land use and assess protectiveness at closed NFSS Vicinity Properties Q, R, X, S, T, and W (See http://www.lrb.usace.army.mil/derpfuds/loow/loow-ws-presentation-doe-2009-12.pdf). The Department of Energy explained that these properties were selected for re-evaluation because of questions raised by local citizens and because these properties are either accessible to the public or adjacent to NFSS drainage ditches. The Department of Energy recently completed "NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches" (DOE 2010), which reviews of all the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx. Public input or questions concerning all closed NFSS vicinity properties should be directed to Bob Darr, Public Affairs Specialist at (720)377-9672 or bob.darr@LM.doe.gov.

Number	Comments	Response
112	(EPA) Section 1.5, Page 1-4, 4th paragraph,: The paragraph states, in part, "The residues containing low levels of radioisotopes (K-65, L-30, and F-32) were placed into the IWCS... " It's unclear what is meant by the term "low levels" in this sentence when historical data indicates radium-226 concentrations as high as 500,000 pCi/g, especially when in the remainder of the RIR refers to sampling results of much lower concentrations as elevated levels. Please explain or revise	As noted in this comment, it is probably not correct to state that the concentrations of radionuclides in the residues were at "low levels." This is especially true for the K-65 residues which have a concentration of radium-226 of about 500,000 pCi/g. The term "low level" as used here refers to the Nuclear Regulatory Commission's designation of two broad classifications of radioactive waste: high-level or low-level waste. High-level radioactive waste can be either spent nuclear fuel (i.e., nuclear fuel that is no longer effective in sustaining a nuclear chain reaction) or the liquid wastes from reprocessing this spent nuclear fuel. Low-level wastes are generally defined as radioactive wastes other than high-level and wastes from uranium recovery operations. Low-level wastes are commonly disposed of in near-surface facilities rather than in a geologic repository that is required for high-level wastes. The radioactivity of low level waste can range from just above background levels to much higher levels.

Number	Comments	Response
113	(EPA) Section 1.5.3.1, Page 1-9: The radiological surveys performed by AEC in 1970 within the LOOW boundary were conducted by using a sodium iodide gamma detector held at a height of one meter above the ground surface. Such surveying method is inefficient to identify contamination in surface soil; and mostly ineffective to identify contamination in, subsurface soil. Therefore, the Corps should consider re-investigating the former AEC; surveyed areas and; if necessary, conduct a historical site assessment for all suspect area, that are located outside the current NFSS site boundary. Given that the Corps identified elevated levels of contamination in previously remediated areas within the NFSS, it is more likely to identify contamination in previously remediated areas outside the NFSS.	The Department of Energy did not remediate the Niagara Falls Storage Site or Vicinity Properties E, E' and G. These properties remain within the authorized scope of the Corps' NFSS Formerly Utilized Sites Remedial Action Program (FUSRAP) and will be thoroughly characterized and remediated by the Corps to meet cleanup criteria and obtain regulatory closure. The Department of Energy is responsible for determining the eligibility of a vicinity property for the FUSRAP. Following regulatory closure of a vicinity property by the Corps, the Department of Energy provides necessary long-term care as needed. The Department of Energy has responsibility for 23 completed vicinity properties near the NFSS. During a community workshop in December 2009 the Department of Energy discussed their intent to review land use and assess protectiveness at closed NFSS Vicinity Properties Q, R, X, S, T, and W (See http://www.lrb.usace.army.mil/derpfuds/loow/loow-ws-presentation-doe-2009-12.pdf). The Department of Energy explained that these properties were selected for re-evaluation because of questions raised by local citizens and because these properties are either accessible to the public or adjacent to NFSS drainage ditches. The Department of Energy recently completed “NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches” (DOE 2010), which reviews of all the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx. Public input or questions concerning all closed NFSS vicinity properties should be directed to Bob Darr, Public Affairs Specialist at (720)377-9672 or bob.darr@LM.doe.gov.

Number	Comments	Response
114	(EPA) Section 1.5.3.2, Page 1-9: It is unclear if the DOE considered a review of archive aerial photographs as part of their study of the NFSS to identify any potential fill areas. It seems that the Corps based their historical site assessment (HSA) on previous work and records obtained from the Department of Energy and it is unclear if a review of archive aerial photographs was part of the HSA. If the HSA did not include a review of archive aerial photograph; then such a review is recommended to identify any potential undocumented areas: - Otherwise, the Corps should state that the HSA included a review of' archival aerial photographs and discuss the findings.	Specific questions on the procedures previously used by the Department of Energy to determine the presence of fill areas should be directed to that agency. A review of archival aerial photos was completed by the Corps as part of the historic site assessment and is included in the site history section of the RIR (Section 1.5). Historic aerial photos were used to locate operational areas during development of the geographic information system for the site. An additional historical survey report based on aerial photos will be generated by the US Army Geospatial Center. The *Niagara Falls Storage Site Historical Photographic Analysis* (USACE 2009) will be presented in the RIR Addendum (Appendix 12-C).

Number	Comments	Response
115	(EPA) Section 1.5.3.2, Page 1-11, 2nd paragraph: Previous remedial actions performed by DOE seem to be conducted under the objective of meeting only general dose rate action levels attributed to external radiation. This can be supported by the Corps RIs, which concluded that elevated levels of radioactivity still exist in previously remediated areas within the NFSS. As such, the Corps should consider re-investigating all vicinity properties previously remediated by DOE to meet the Corps remedial action objectives.	The Department of Energy did not remediate the Niagara Falls Storage Site or Vicinity Properties E, E' and G. These properties remain within the authorized scope of the Corps' NFSS Formerly Utilized Sites Remedial Action Program (FUSRAP) and will be thoroughly characterized and remediated by the Corps to meet cleanup criteria and obtain regulatory closure. The Department of Energy is responsible for determining the eligibility of a vicinity property for the FUSRAP. Following regulatory closure of a vicinity property by the Corps, the Department of Energy provides necessary long-term care as needed. The Department of Energy has responsibility for 23 completed vicinity properties near the NFSS. During a community workshop in December 2009 the Department of Energy discussed their intent to review land use and assess protectiveness at closed NFSS Vicinity Properties Q, R, X, S, T, and W (See http://www.lrb.usace.army.mil/derpfuds/loow/loow-ws-presentation-doe-2009-12.pdf). The Department of Energy explained that these properties were selected for re-evaluation because of questions raised by local citizens and because these properties are either accessible to the public or adjacent to NFSS drainage ditches. The Department of Energy recently completed “NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches” (DOE 2010), which reviews of all the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx. Public input or questions concerning all closed NFSS vicinity properties should be directed to Bob Darr, Public Affairs Specialist at (720)377-9672 or bob.darr@LM.doe.gov.

Number	Comments	Response
116	(EPA) Section 3.1, Page 3-4, 1st paragraph: Given that the ditches are inundated 50% of the year, were the inaccessible areas investigated? If not, inaccessible areas should be investigated in future field activities.	Sediment and surface water samples were collected from the areas that were inundated. The NFSS Baseline Risk Assessment database includes analytical results for 115 sediment samples, and 98 surface water samples. For defining environmental media within exposure units, sediments were operationally defined as being in ditches that are submerged (wet) for at least six months of the year (i.e., 50 percent of the year). Only Exposure Units 5, 9, 15, 16, and 17 contain surface water and sediment (BRA, Section 2.2.2.2).
117	(EPA) Section 3.4.3.3, Page 3-9: While sampling, pebbles were removed from the sample. At times, the radioactive material could be in the form of chunks of slag. After removing the pebbles, were they scanned prior to discarding them?	Yes, all samples collected were scanned prior to disposal. Normally, the pebbles did not exhibit activity and were omitted from the remaining mass of the sample.

Number	Comments	Response
118	(EPA) Section 3.12.2.3, Page 3-31: Given the previous site operational history, the outfalls at Niagara River need to be investigated.	Between August and October of 2006, the Corps collected a total of 60 samples for radiological analysis from within or adjacent to underground utility lines on the former LOOW site including the 30-inch outfall to the Niagara River. Samples were analyzed for radiological constituents including, but not limited to, isotopic uranium, isotopic thorium, radium-226, and radium-228. The results of this sampling were reported in a FUSRAP Fact Sheet available online at http://www.lrb.usace.army.mil/derpfuds/loow-nfss/loow-fs-radundgutil-2007-10.pdf. Further evaluation will be included in the RIR Addendum (Section 10.0). The sanitary sewer and acid lines extending from the NFSS to CWM were plugged by the Corps in 2006. In addition, the LOOW acid waste sewer and sanitary sewer lines were plugged in the area just north of M Street as part of the consent order issued by NYSDEC in 1978 to SCA, (the predecessor of CWM). The LOOW Underground Utilities Remedial Investigation, to be provided as Appendix 12-E in the RIR Addendum, confirmed that the pipelines leaving the NFSS did not have bedding material and were grouted to avoid potential transport of radiological contamination offsite. However, the discharge line, referred to as the 30-inch outfall, from the former LOOW wastewater treatment plant to the Niagara River was retrofitted by the Town of Lewiston for use in their public sanitary sewer system. Although the line did not prove adequate for use as a sanitary sewer, the Town of Lewiston currently uses a portion of the line west of the southwest drainage ditch as a stormwater sewer.
119	(EPA) Chapter 4, Tables: A footnote needs to be included for all applicable tables associated with Chapter 4 to explain the meaning of the dashed lines "—". Do the dashed lines mean the ROC or COC wasn't detected or wasn't analyzed for? Please define the meaning of the dashed lines.	Noted. The dashed line implies that the constituent was not detected. .

Number	Comments	Response
120	(EPA) Chapter 4, Tables: The tables associated with the surface soil results include surface soils collected from a depth 0-0.5'. While the tables associated with subsurface soil include all surface and surface soil samples collected from a depth of 0-10'. This provides an overlap of data presentation. Although this type of presentation may be beneficial for the Baseline Risk Assessment, the data should be provided separately in the RIR (e.g., surface soil includes data for samples collected from 0-0.5', and subsurface soil includes data for samples collected from 0.5-10') to aid in identifying the source of the groundwater plume. More importantly, the depth of contamination is essential for the purpose of groundwater modeling and the way the data is presented makes it difficult for others to reuse the data in groundwater modeling efforts. The soil data should be separated accordingly without an overlap of the results. It would be very beneficial if a table is provided indicating the depth of every individual sample.	Noted. The RI database is available from the Corps in an electronic format, and data sorting and segregation can be done to meet the needs of various end users. Given the amount of soil data currently available for the NFSS, a table with the requested information would be large and unwieldy. However the information is available through a Freedom of Information Act (FOIA) request. A FOIA request can be made by completing the form available on the web at: http://www.lrb.usace.army.mil/derpfuds/loow-nfss/FOIA%20request%20form.pdf The completed form should be submitted to the Buffalo District FOIA Coordinator listed on the form. Regarding the groundwater model results and use, the SESOIL modeling of Balance of Plant soil accounts for exposure unit-specific vertical profiles of contamination and associated loading (leaching) to the underlying groundwater. The SESOIL leaching areas are broadly defined within each exposure unit for conservatism (assumes non-point distributions); the extents are based on contiguous soil contamination. The SESOIL output was then input to the 3-D MODFLOW-SURFACT model as contaminant loads to the water table in the upper water-bearing zone. The modeling animations and Appendices E and F of the Groundwater Model provide the SESOIL and MODFLOW-SURFACT results.

Number	Comments	Response
121	(EPA) Sections 4.4.2, Page 4-7, Step 1: The paragraph states "the frequency of detection for each parameter in each data set was determined. Parameters that were not detected in at least 5 percent of the samples in each exposure unit/medium were dropped from further evaluation and were not considered to be site-related constituents ". Screening site-related constituents based on the frequency of detection may be an acceptable method only when sufficient sampling locations are considered to define the extent of contamination. EPA believes that additional sampling locations need to be installed to define groundwater plumes in on-site and off-site areas. Therefore, it may be premature to eliminate contaminants from the list of site-related constituents when more data is needed, especially the deletion of radium-226 and radium-228, which are the primary on-site contaminants and are found at elevated concentrations on Exposure Unit 4, Exposure Unit 10 and Exposure Unit 11. Further, the Corps should give consideration to mitigating contaminants found in point-source areas.	The RI was an 8-year effort, which included 3 phases of field investigation. During the RI, more than 1,400 samples were collected and more than 150,000 analytical results were recorded. With this amount of data, the Corps does not feel that it was premature to screen site-related constituents based on frequency of detection. Note also that radium-226 and radium-228 were identified as radionuclides of concern for the residential scenarios for site-wide groundwater. Total and dissolved radium-226 and radium-228 detection maps were submitted to EPA, however, the location of positive detection points were scattered so no plumes could be drawn. To further define groundwater plumes, additional on-site and off-site sampling was conducted in three areas of interest during the RIR Addendum field activities. The first area, northwest of the NFSS property, is where the uranium plume appears to cross the site boundary. Off-site testing in this area was needed to define the extent of the uranium plume. The second area of interest concerns Exposure Units 7, 9, 10 and 11, for which further sampling was conducted to define plumes north, west and south of the IWCS and to investigate the potential for the interconnection between groundwater and surface water in the West Drainage Ditch. The third area is Exposure Unit 4 where further delineation of organic solvents is needed. Results of additional sampling conducted in these areas will be presented in the RIR Addendum (Sections 3.0 and 4.0) As the FS commences, it may be possible to more closely define the extent of the groundwater plumes around smaller source areas, which would provide a better planning dataset.
122	(EPA) Chapter 5: The total-uranium sediment/soil sample results are reported in units of µg/g. While EPA understands the purpose of reporting the total-uranium groundwater sample results in µg/L, it is unclear of what is the benefit of reporting soil/sediment samples results in units of µg/g.	The units for total-uranium in solid matrices were the same units as those used by the analytical laboratory. Since µg/g is equivalent to the more traditional units of mg/kg, reporting soil and sediment results in µg/g has no effect on conclusions drawn from this data.

Number	Comments	Response
123	(EPA) Section 5.1.1, Page 5-3, 3rd paragraph: This paragraph talks about the use of total uranium in µg/L rather than the sum of the uranium isotopes in pCi/L. We understand that the total uranium results in µg/L reported in the RIR were obtained via the metals analytical method instead of obtaining it by using the specific activities for each uranium isotope to convert the total uranium from pCi/L to µg/L. We also understand that the conversion factor of 0.9 to convert the total uranium from pCi/L to µg/L as stated in the Drinking Water Act can't be used because this factor only applies to natural uranium, whereas the uranium at NFSS is not natural and thus the isotopic uranium ratios differ. EPA performed a comparison between total uranium results obtained via the metals analytical method and those calculated by using the specific activities for each uranium isotope to determine the appropriateness of the metals analytical method. The results are included in Table 1, which is attached at the end of the comments. Overall the metals analytical method seems to be an appropriate method to estimate total-uranium with some comments, which are listed below. - The total total-uranium results for Exposure Unit 6 seem to be underestimated by approximately 30%. We recommend using the individual uranium specific activities to calculate total uranium when there is a significant difference between the results.	The comment notes that EPA performed a comparison between uranium results obtained via the metals analytical method and those calculated by using the specific activities for each uranium isotope to determine the appropriateness of the metals analytical method. EPA concluded that overall the analytical method seems to be an appropriate method to estimate total uranium with a few exceptions, which were noted in the comment. The results of the EPA comparisons were included in an attachment to the comments as Table 1. In evaluating the results presented in Table 1, it appears that the maximum concentrations within each exposure unit for each uranium isotope were used to estimate the total uranium concentrations (ug/L) for both dissolved and total fractions. These estimated total uranium concentrations were then compared to the maximum total uranium results obtained from the metals analytical method. The maximum values for the isotopic uranium and the total uranium estimates may all be from different samples collected at different locations within an exposure unit. For example, the maximum uranium-238 result may be from a different sample and location than either the maximum uranium-234 or uranium-235 result or the maximum total uranium result. The Corps re-evaluated data for each sample result where all three isotopes were detected and determined the total uranium result for each sample using the isotopic concentrations and their associated specific activities. This estimated total uranium result was then compared to the total uranium result obtained using the metals analytical method for that same sample. The Corps found that the average site-wide ratio calculated by comparing the metals methodology results to the isotopic methodology results was 0.95 for dissolved uranium and approximately 1.03 for total (unfiltered) uranium. Below is an example of a sample evaluation performed by the Corps.

Number	Comments	Response
123 (cont.)	- The maximum detected dissolved total-uranium result for Exposure Unit 10 appears to be entered incorrectly (Table 4-104). This number may need to be 958 µg/L instead of the reported value of 9580 µg/L. Please check the number and revise if necessary. If there is a significant underestimate between the revised number and the calculated number, then the calculated number should be used. Note that the dissolved total-uranium result of 9580 µg/L is also reported in Table 4-118. - The total total-uranium results for Exposure Unit 10 seem to be underestimated by approximately 60%. We recommend using the individual uranium specific activities to calculate total uranium when there is a significant underestimate between the results. - The dissolved total uranium results for Exposure Unit 11 seem to be underestimated by approximately 63%. We recommend using the individual uranium specific activities to calculate total uranium when there is a significant underestimate between the results. - The dissolved total-uranium results for Exposure Unit 13 seem to be underestimated by approximately 21%. We recommend using the individual uranium specific activities to calculate total uranium when there is a significant underestimate between the results.	• In Exposure Unit 11, the maximum dissolved total uranium concentration obtained from the metals analytical method was 51 µg/L. The corresponding uranium-234, -235, and -238 activities in this sample were 23.6 pCi/L, 0.901 pCi/L, and 18 pCi/L. The estimated dissolved total uranium concentration obtained using the specific activities for these three radionuclides along with these measured concentrations is 54.31 µg/L, which is very similar to the estimated concentration of 51 µg/L obtained from the metals analytical method. The resulting comparison ratio for the two concentrations is 0.94. This ratio demonstrates a fairly close 1:1 relationship between dissolved total uranium concentrations obtained from the metals analytical method and from use of isotope-specific activities. This is in contrast to the ratio of 0.37 shown on Table 1 attached to this comment. Recalculation of comparison ratios using specific activities from a discreet sample resulted in a comparison ratio of 1.14 for total uranium in Exposure Unit 6, an increase from 0.69 as presented in Table 1. The database for Exposure Unit 10 included a maximum detected value for dissolved total uranium that was incorrectly reported as 10 times higher than the actual value. When this number is corrected to the actual value of 958 µg/L, the ratio between the metals analytical method and the specific activity method for Exposure Unit 10 decreases to 1.04. As stated previously, the Corps found that the site-wide average ratio calculated by comparing the metals methodology results to the isotopic methodology results was 0.95 for dissolved uranium and approximately 1.03 for total (unfiltered) uranium. These ratios suggest that, on a site-wide basis, a close relationship exists between uranium concentrations estimated using both methods.

Number	Comments	Response
124	(EPA) Section 5.1.1, Page 5-3, last paragraph: This paragraph talks about the use of total and dissolved radionuclide concentrations in groundwater plumes and modeling. It is unclear why the total radionuclide concentrations were only used to define the plume and were excluded from the groundwater modeling. The Corps has collected data on the groundwater chemistry (i.e., carbonate, sulfate, phosphate, fluoride, chloride, silicate, pH, etc) that can influence the solubility and insolubility of radionuclides in groundwater. As such, both total and dissolved data along with the groundwater chemistry should be used in the groundwater modeling.	For metal and radionuclide site-related compounds, both total and dissolved concentrations were used to evaluate the existence of a groundwater plume (RIR, Section 5.1.1). Only dissolved concentrations were used to define the iso-concentrations (i.e., the shape and extent of the plumes) used in the groundwater model. Three “source terms” were used to represent initial conditions in the model: (1.) The results of Hydrologic Evaluation of Landfill Performance (HELP) and one dimensional (1-D) MODFLOW-SURFACT modeling were applied to the IWCS to estimate vertical transport of contaminants assuming IWCS contents were unsaturated; (2.) SESOIL model results were used to estimate leachate concentrations predicted to reach the upper water-bearing zone within the 1,000-year timeframe considered in the RI/FS; and (3) Existing plume maps were used to identify areas on-site where current groundwater concentrations exceed background levels, as appropriate(Groundwater Model, Sections 4.2 through 4.4) . Total fraction samples from new or temporary well points at the NFSS were commonly turbid, so filtered samples better represent advective/dispersive/adsorptive groundwater transport rather than a colloidal condition that would not occur in the hydraulically tight (low K) upper water-bearing zone. A MINTEQA2 geochemical evaluation conducted to evaluate constituent solubility is included in Appendix D of the Groundwater Flow and Contaminant Transport Modeling Report. NFSS-specific groundwater chemistry was taken into consideration for the MINTEQ modeling that was performed as part of the geochemical analysis. The MINTEQ results were used in the IWCS leaching model that employed a solubility limiting function to ensure recalcitrance of IWCS sources, and thus a more accurate transport scenario. The solubility results also were used in the SESOIL modeling of Balance of Plant soil sources (BRA, Section 2.2.3.2 and Appendix E).

Number	Comments	Response
124 (cont.)		Please note that the Baseline Risk Assessment did utilize the concentrations of metals and radionuclides measured in the total (unfiltered) groundwater fraction to develop exposure point concentrations for a hypothetical future farmer who might use the groundwater as a drinking water source (BRA, Section 2.5.1).
125	(EPA) Section 5.2 (Exposure Units 1 and 2), Page 5-4: Certain soil samples collected from Exposure Unit 1 exhibited trace amounts of Cs-137 which may be attributed to the storage of KAPL waste in this exposure unit. Therefore, because KAPL waste also included plutonium, then the soil in this exposure unit should be investigated for the potential presence of plutonium.	To characterize areas potentially impacted with KAPL material, the RI included biased sampling for plutonium where elevated levels of cesium-137 were detected. Since there is documentation to support the storage of KAPL waste in the Baker Smith Area (Exposure Unit 1), cesium-137 was analyzed for in Exposure Unit 1 surface soil at 52 locations and plutonium was analyzed for in one soil location. Cesium-137 was identified as a radionuclide of concern for Exposure Unit 1 but plutonium was not (RIR, Section 7.3.1). After the RIR was complete it was discovered that an additional 17 surface soil sampling points for plutonium were inadvertently left out of the RI data set. The inadvertently omitted data will be included in the RIR Addendum (Section 11.0), however, the sample results were non-detects or low-level detects and therefore, would not change the conclusions on nature and extent and risk already discussed in the NFSS RI/Baseline Risk Assessment Reports. Plutonium was detected on site, but at levels below those that would pose an unacceptable risk, even under the most conservative farming scenario. Therefore, plutonium was not identified as a radionuclide of concern. However, since the presence of plutonium may affect acceptance of NFSS-generated waste at a potential disposal site (even though they may not pose an unacceptable environmental or human health risks), it will continue to be evaluated during the project.

Number	Comments	Response
126	(EPA) Section 5.2 (Exposure Unit 1 and 2), Page 5-4: It is unclear whether groundwater samples collected from Exposure Unit 1 were analyzed for Cs-137 and plutonium isotopes (Table 4-96). Given that there is a groundwater plume migrating from Exposure Unit 2 towards Exposure Unit 1 and the fact that Cs-137 was identified in Exposure Unit 2 groundwater at a maximum concentration of 61.5 pCi/L, groundwater samples collected from Exposure Unit 1 should be analyzed for both Cs-137 and Pu-239 and those collected from Exposure Unit 2 should also include the analyses for Pu-239.	As indicated in Table 4-96 of the RIR, dissolved cesium-137 was analyzed for in four groundwater samples collected from Exposure Unit 1. No plutonium data is available for Exposure Unit 1 groundwater. In October 2008, the Environmental Surveillance Program was expanded to include wells previously showing detectable levels of cesium-137, most of which were from total fraction samples with high turbidity that might account for the detections. The one-time, more recent sampling results did not replicate the cesium-137 detections. Based upon RI findings, additional groundwater sampling was conducted in late 2009 at Exposure Unit 1 and the area northwest of the NFSS property where the uranium plume appears to cross the site boundary onto the Town of Lewiston property (former LOOW wastewater treatment plant). This investigation included analysis for cesium-137 and plutonium and the results will be presented in the RIR Addendum (Sections 3.0 and 11.0).
127	(EPA) Section 5.2 (Exposure Units 1 and 2), Page 5-4: Given the fact that there is a plume along the northern boundary of Exposure Unit 1, off-site monitoring wells north of Exposure Unit 1 are necessary to identify and delineate a potential off-site plume.	Concur. Additional groundwater sampling was conducted in late 2009 at Exposure Unit 1 and the area northwest of the NFSS property where the uranium plume appears to cross the site boundary. This investigation will help to further define the extent of the uranium plume and the results will be presented in the RIR Addendum (Sections 3.0 and 4.2).
128	(EPA) Section 5.3 (Exposure Units 3 and 4), Page 5-14: It is unclear why the dissolved analyses for all radionuclides are not reported in Table 4-98 for Exposure Unit 3. Please include such results or explain why the dissolved analyses were not performed/included.	All available analytical results for Exposure Unit 3 groundwater are reported in RIR Table 4-98. During the RI, three temporary well points (TWP407, TWP409 and C5-AC-BP3) in Exposure Unit 3 were sampled to investigate the presence or absence of radiological and chemical compounds in the groundwater near the former railroad lines and the property boundary, and to investigate previously identified compounds in soil near this area (RIR, Section 5.3). Based on process knowledge, the principle focus of the Exposure Unit 3 investigation of groundwater was total and dissolved metals. Since radionuclides were not the principle focus of this investigation, analysis for radionuclides was run for only for the total fraction (unfiltered) samples.

Number	Comments	Response
129	(EPA) Section 5.3 (Exposure Units 3 and 4), Page 5-14: Cs-137 was identified in surface soil and in groundwater while it was not identified in subsurface soil. Therefore, there is a chance that Cs-137 was either missed in subsurface soil or the Cs-137 in surface soil is isolated from that identified in groundwater, thus raising the possibility of a Cs-137 groundwater plume entering exposure unit from another exposure unit. Further evaluation for potential Cs-137 plume in groundwater may be necessary.	Cesium-137 was identified as a site-related compound in subsurface soil in Exposure Units 3 and 4. Cesium-137 was detected above the background level in 2 out of 40 subsurface soil samples in Exposure Unit 3 and 27 out of 69 subsurface soil samples in Exposure Unit 4. Cesium-137 was detected in 1 out of 12 groundwater samples collected in the area, so no cesium-137 groundwater plume was identified (RIR, Section 5.3).
130	(EPA) Section 5.3 (Exposure Units 3 and 4), Page 5-14: A maximum concentration of total radium-226 and total radium-228 of 10.7 pCi/L and 70.4 pCi/L, respectively, are identified in the groundwater of Exposure Unit 4. It is unclear why a figure to show a radium plume for Exposure Unit 4 is not provided in the RIR. Such figure should be provided.	For radium-228, there was a single elevated concentration value in groundwater, which does not indicate the presence of a groundwater plume. For radium-226, there were only two Exposure Unit 4 locations where groundwater concentrations exceeded background levels. The maximum total and dissolved groundwater concentrations for radium-226, radium-228, thorium-230 and thorium-232 in site-wide groundwater are all less than their respective drinking water standards. While the concentrations of radium-226 and radium-228 could increase in the future due to ingrowth from thorium, it is highly unlikely that this ingrowth would result in concentrations exceeding the 5 pCi/L drinking water standard for radium-226 and radium-228 combined. Please note that the Baseline Risk Assessment did utilize the concentrations of metals and radionuclides measured in the total (unfiltered) groundwater fraction to develop exposure point concentrations for a hypothetical future farmer who might use the groundwater as a drinking water source (BRA, Section 2.5.1).

Number	Comments	Response
131	(USEPA) Section 5.3 (EU 3 and 4), Page 5-14: The elevated concentrations total radium-226 and radium-228 need to be addressed in this section.	The occurrence and distribution of elevated levels of radionuclides, including radium-226 and radium-228, in various environmental media is discussed in the RIR (Section 5.3, USACE 2007a). For radium-228, there was a single elevated concentration value in Exposure Units 3 and 4 groundwater, which does not indicate the presence of a groundwater plume. For radium -226 there were only two Exposure Unit 4 locations where groundwater concentrations exceeded background levels. The maximum total and dissolved groundwater concentrations for radium-226, radium-228, thorium-230 and thorium-232 in site-wide groundwater are all less than their respective drinking water standards. While the concentrations of radium-226 and radium-228 could increase in the future due to ingrowth from thorium, it is highly unlikely that this ingrowth would result in concentrations exceeding the 5 pCi/L drinking water standard for radium-226 and radium-228 combined. Please note that the data used to characterize the distribution of chemicals and radionuclides in this area was also used by the Baseline Risk Assessment to characterize potential risk to hypothetical future receptors including a subsistence farmer and a resident (BRA, USACE2007b). The Baseline Risk Assessment identified radium-226 as a radionuclide of concern in Exposure Unit 3 soil and both radium-226 and radium-228 as radionuclides of concern for Exposure Unit 4 soil. Compounds identified as radionuclides of concern will be addressed further by the FS.

Number	Comments	Response
132	(USEPA) Section 5.5.1.4 (EU 8), Page 5-38: In addition to the uranium plume in groundwater, there is a potential to have a radium plume. That is, the sum of thorium-230 and thorium 232 may slightly exceed 5 pCi/L. Because both of the aforementioned thorium isotopes are parents to radium-226 and radium-228, respectively, there is a potential ingrowth of radium that may exceed the MCL in the future. Further groundwater sampling of thorium may be needed in this EU.	Two thorium-230 plumes located near the site boundary (one in Exposure Unit 4 and one in Exposure Unit 7/10) were evaluated for future risks due to ingrowth because it is feasible that radium concentrations in groundwater could increase the presence of parent thorium isotopes: thorium-230 for radium-226 and thorium-232 for radium-228. The maximum total and dissolved groundwater concentrations for radium-226, radium-228, thorium-230 and thorium-232 are all less than the respective drinking water standard (Maximum Contaminant Level or MCL). While the concentrations of radium-226 and radium-228 could increase in the future, it is highly unlikely that this ingrowth would result in concentrations exceeding the drinking water standard, or MCL, of 5 pCi/L for radium-226 and radium-228 combined. Radionuclide ingrowth occurs as a function of the daughter radionuclide's half-life (the half-life of radium-226 is 1,600 years and the half-life of radium-228 is 5.8 years). This means that radium-228 will come into secular equilibrium with thorium-232 in several decades, but it will take several thousands of years for significant ingrowth of radium-226 to occur. Any increase in the concentration of these two radium isotopes due to radionuclide ingrowth will be more than offset by dilution and attenuation within the groundwater system. It was concluded that since the reported radium concentrations in the Exposure Units 4 and 7/10 plumes are currently less than the drinking water standard (considering both total and dissolved results) that ingrowth would not result in an exceedance of the drinking water standard over the next 1,000 years without the introduction of a secondary source of contamination. Total and dissolved radium-226 and radium-228 detection maps were submitted to EPA, however, the location of positive detection points were scattered so no plumes could be drawn.

Number	Comments	Response
133	(USEPA) Section 5.6.1.4, 2nd bullet (EU 7, 10 and 11), Page 5-49: The uranium plume found on the south side of the IWCS may be associated with the sanitary sewer and water lines, while the uranium plumes found on the north and west sides of the IWCS are not associated with any source. The source of such plume needs to be identified and reported in the RIR.	The groundwater plume located southeast of the IWCS is believed to be associated with operations conducted at former Building 409, located south of the IWCS and used as a secondary water reservoir associated with the LOOW fresh water treatment plant. The source of the groundwater plumes located north and west of the IWCS is believed to be historical activities and runoff from the R-10 pile. A discussion of the former Building 409 and the R-10 pile as potential sources for the groundwater contamination found adjacent to the IWCS is further discussed in RIR Section 5.6.3.
134	(USEPA) Section 5.6.1.4, (EU 7, 10 and 11), Page 5-49: In Table 4-118, the total and dissolved radium-226 concentrations collected from monitoring well GWTWP851-3565 are 2.59 and 2.75 pCi/L, respective. The "equality" in such results suggests that radium-226 may be present in a soluble form. Yet, four other wells exhibiting total radium-226 concentrations ranging from 4.58 to 11.3 pCi/L, don't have reported results for dissolved radium-226. Similarly, a total of seven monitoring wells exhibiting elevated concentrations of total radium-228 ranging from 8.59 to 126 pCi/L did not have dissolved radium-228 data reported in the RIR. Please explain if whether groundwater samples exhibiting elevated concentrations of total radium-226 and radium-228 were also analyzed for dissolved radium-226 and radium-228. Analyses on dissolved radium-226 and radium-228 must be performed on those samples that exhibited elevated concentrations of total radium-226 and radium-228.	The inclusion of analysis for dissolved radionuclides in groundwater, such as dissolved radium, changed over the course of the remedial investigation project. Initially, when many of the samples were collected from temporary well points, analysis for both total and dissolved radionuclides for each groundwater sample was conducted to evaluate the impact of suspended solids introduced into the water sample due to construction of the temporary well point and/or sampling procedures. Later, it was decided that samples would be analyzed for dissolved radionuclides only when the total result exceeded specified risk-based values. Analysis of dissolved samples was omitted during some sampling efforts, primarily because dissolved values are not comparable to regulatory limits. Dissolved groundwater results were included in the RIR database but only total groundwater results were used to assess risk in the Baseline Risk Assessment.

Number	Comments	Response
135	(USEPA) Section 5.6.1.4, 4th bullet (EU 7, 10 and 11), Page 5-49: This paragraph discusses the detection of elevated concentrations of Cs-137 in EU 10 during the phase 2 sampling activities and then Cs-137 was not detected during the phase 3 sampling activities. The reasoning of such behavior and the source of Cs-137 in EU 10 should be discussed.	Although the occurrence of cesium-137 noted in the 4th bullet on page 5-49 does seem odd, the next bullet explains that the data were evaluated in the Baseline Risk Assessment and not found to pose an unacceptable risk, even when assuming water containing these concentrations was consumed (such as in the farming scenario). As described in the RIR Section 5.2.1.4, the Phase 2 detections of cesium-137 were below a derived drinking water standard (Maximum Contaminant Level) (110 pCi/L). Furthermore, in October 2008 the Environmental Surveillance Program was expanded at wells that had exhibited elevated cesium concentrations in the past. The elevated levels of cesium-137 detected in groundwater during the NFSS RI could not be replicated and may be due to high turbidity in the total-fraction samples. Additional sampling for cesium-137 in groundwater was conducted in the fall of 2009 and the results will be reported in the RIR Addendum (Section 3.4, USACE 2010).
136	(USEPA) Section 5.6.1.4 (EU 7, 10 and 11), Page 5-49: Elevated concentrations of radium-226 and radium-228 were identified in EU 10 groundwater samples, yet neither the results nor the source were discussed in this section. The results and the source of the elevated radium concentrations need to be addressed in this section.	A discussion of the presence of radiological constituents in Exposure Units 7, 10 and 11 groundwater and potential sources due to past use is presented in Section 5.6.3 of the RIR. Radium-226 and radium-228 detection maps were forwarded to EPA; however, the location of positive detection points were scattered so no plumes could be drawn.
137	(USEPA) Section 5.6.1.4 (EU 7, 10 and 11), Page 5-49: A sufficient number of wells exhibiting total radium-226 and radium-228 in excess of the MCL in EU 10 and at least two wells in EU 11 we identified. Yet no figures were provided to show the plumes for radium-226 and radium-228. Such figures need to be included in the RIR.	Total and dissolved radium-226 and radium-228 detection maps were forwarded to EPA; however, the location of positive detection points were scattered so no plumes could be drawn.

Number	Comments	Response
138	(USEPA) Section 5.9.4.1, Page 5-66: The paragraph states, in part, "For example, there were only three very low detections for plutonium 239/240 out of 34 samples analyzed. These detections occurred in EU 8, EU 11, and EU 13 at concentrations of '0.322, 0.129, and 0.536 pCi/g, respectively." This section needs to address the plutonium-239 concentration of 5.72 pCi/g that was found in Railroad Ballast and Core Samples, which is listed in Table 4-2 of the RIR.	A data summary of positive detections in railroad ballast and core samples is provided in RIR Table 4.2 and a discussion of these results is provided in Section 5.10.1.6. Section 8.0 of the RIR Addendum will include a comparison of positive detections in railroad ballast and core samples to surface soil background levels and risk-based limits.
139	(USEPA) Section 5.9.5, Page 5-72: Further evaluation of fission products in the UWBZ is recommended, especially Cs-137 and to a lesser extent Pu-239 unless new data reveals significant changes in the levels of plutonium.	Total and dissolved cesium-137 detection maps were forwarded to EPA; however, the location of positive detection points were scattered so no plumes could be drawn. In October 2008, the Environmental Surveillance Program was expanded to include wells previously showing detectable levels of cesium-137 in groundwater, most of which were from total fraction samples with high turbidity that might account for the detections. The more recent sampling results did not replicate the cesium-137 detections in groundwater. Also, based upon RI findings, additional groundwater sampling was conducted on site which included groundwater analysis for cesium-137 and plutonium-239. Results from the expanded Environmental Surveillance Program sampling and the RIR Addendum investigations will be presented in the RIR Addendum (Section 9.0).

Number	Comments	Response
140	(USEPA) Section 5.10.1.2, Page 5-73: Although the maximum concentration (i.e., 3.66 pCi/L) of radium-226 may not be too significant under the current discharge conditions, consideration should be given to historical off-site surface water discharges where radiological concentrations could be more significant, which can be supported by the presence of much higher levels of radioactivity in sediment samples collected from the on-site ditches. Therefore, USACE should consider investigation off-site sediment and surface water bodies.	Data collected during the RI indicates that both the Central and West Drainage Ditch received slightly impacted surface water from the Modern property. This was due to upstream soil disturbance that was occurring on the Modern property, as well as site clearing activities on the NFSS during the RI period. The Environmental Surveillance Program data for the Central Drainage Ditch shows significantly higher uranium hits in surface water and sediment in the 2001-2002 timeframe, which then declines with time (USACE 2009). The mobility of radionuclides in surface runoff may have been enhanced by ground disturbing activities preceding RI field operations and low pH, or acid rainfall, both of which may increase water-sample concentrations due to increased turbidity and dissolution or solubility of naturally occurring cations from disturbed soil and/or sediment On-site surface water and sediment in the main ditch system including Central Ditch, South 16 Ditch, South 31 Ditch and Modern Ditch were assessed in the RI as Exposure Unit 15 and no radionuclides of concern were identified in on-site surface water or sediments (RIR, Section 7.3.15). In October 2008, three new surface water and sediment locations in the West Drainage Ditch were added to the Environmental Surveillance Program sampling. The results from these new surface water and sediment locations in the West Drainage Ditch will be reported in an RIR Addendum (Section 9.0). Initial analysis indicates no detectable contamination.

Number	Comments	Response
141	(USEPA) Section 5.10.1.3, Page 5-74: USACE should consider investigating off-site sediment and surface water bodies that could have been potentially impacted by historical off-site discharges.	As noted in the RIR, several ditches on site collect surface water runoff. Over most of the site, surface water is conveyed through east-west ditches that empty into the Central Drainage Ditch (RIR, Section 2.3.2 and Figure 2-1). The Central Drainage Ditch flows off site to the north and joins Four Mile Creek about 1.5 miles north of the NFSS. Surface water runoff from the western periphery of the site flows to the West Drainage Ditch that flows north and joins the Central Drainage Ditch approximately 0.5 miles north of the NFSS. On site monitoring of surface water and sediment from the West and Central Drainage Ditches is conducted as part of the Environmental Surveillance Program (USACE 2009). This monitoring shows lower levels of uranium than the values reported in the RIR. Under the Formerly Utilized Sites Remedial Action Program (FUSRAP), the Corps is authorized to investigate the potential for radiological and chemical contamination due to past government activity on the 191-acre federally-owned NFSS and three open NFSS vicinity properties; Vicinity Property G, Vicinity Property E, and Vicinity Property E'. The investigation of impacts to surface water and sediments at other off site areas, including closed vicinity properties, would have to be conducted by the Department of Energy. The Department of Energy recently completed "NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches" (DOE 2010), which reviews all of the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx
142	(USEPA) Section 5.10.1.4, Page 5-74: The presence of elevated concentrations of radium-226 and radium-228 found in many monitoring wells collected from the UWBZ should also be discussed in this section.	Total and dissolved radium-226 and radium-228 detection maps were forwarded by the Corps for submittal and discussion with EPA. Nearly all Ra-226 and -228 detections were from total fraction samples and thus potentially reflect turbidity artifacts.

Number	Comments	Response
143	(USEPA) Section 6.3, Page 6-6, 3rd paragraph, 1st sentence: This may be true under current conditions. Future scenarios where the sediment may be relocated and thus increasing the exposure duration should be considered to assess the risk and the need for remedial action or institutional controls. Also, off-site sediments that could have been impacted by former discharges should be investigated and the associated risks assessed.	In the Baseline Risk Assessment, the Exposure Unit 15 analysis examined future risks to several potential receptors from exposure to surface water and sediment in the central ditch and tributary ditches (BRA, Section 2.4.3.15). Even under the most conservative scenario analyzed, resident farm child, no chemicals or radionuclides of concern were identified. Under the Formerly Utilized Sites Remedial Action Program (FUSRAP), the Corps is authorized to investigate the potential for radiological and chemical contamination due to past government activity on the 191-acre federally-owned NFSS and three open NFSS vicinity properties; Vicinity Property G, Vicinity Property E, and Vicinity Property E'. The investigation of impacts to surface water and sediments at other off site areas, including closed vicinity properties, would have to be conducted by the Department of Energy. The Department of Energy recently completed "NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches" (DOE 2010), which reviews all of the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx

Number	Comments	Response
144	(USEPA) Section 6.4, Page 6-7, 2nd paragraph, 3rd sentence: Off-site surface water should be investigated and the associated risks assessed.	Offsite surface water and sediment were evaluated west of the IWCS in EU 9. In October 2008, the Environmental Surveillance Program sampling was expanded to include three new surface water and sediment locations in the West Drainage Ditch (EU 9). The results from these new surface water and sediment locations in the West Drainage Ditch will be reported in an RIR Addendum (Section 9.0). Under FUSRAP, the Corps is authorized to investigate the potential for radiological and chemical contamination due to past government activity on the 191-acre federally-owned NFSS and on three open NFSS vicinity properties; Vicinity Property G, Vicinity Property E, and Vicinity Property E'. The investigation of impacts to surface water and sediments at other off site areas, including closed vicinity properties, would have to be conducted by the Department of Energy. The Department of Energy recently completed "NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches (DOE 2010), which reviews all of the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx

Number	Comments	Response
145	(USEPA) Section 6.6, Page 6-8, 1st paragraph: USACE should also consider including off-site groundwater monitoring in their annual monitoring report. Figure 4-9 of Appendix E of the RIR shows locations of private wells within a 3 ½ mile radius of NFSS in 1994. As a safety measure, USACE should also consider monitoring private well #2, which is located north-northwest at a distance of 1 ½ miles down gradient of NFSS.	To further delineate potential offsite impacts to groundwater located near Exposure Units 1, 4, and 9, additional wells were installed during the RIR Addendum field investigations. The location of these wells were optimized by examining existing boring logs to locate potential sand lenses and through the installation of temporary well points in the areas of interest. The results of this investigation will be presented in the RIR Addendum (Section 4.0). During the "Private Well Study", conducted in September and October 2005 by the Niagara County Department of Health (available on the internet at www.niagaracounty.com/docs/loowrpt.PDF), gross alpha and gross beta measurements were below the objectives established by the regulatory agencies in all samples and all nuclear parameters (uranium-238, thorium-232, potassium-40, ruthenium-106, cesium-134, cesium-137, cobalt-60, radium-226, uranium-235) were below detection limits and the drinking water standard (Maximum Contaminant Limit). All private wells sampled met safe drinking water standards with respect to radiological quality, including private well #2. Potential offsite impacts northeast of the NFSS will be further investigated through the installation of additional monitoring wells that will be included in the Environmental Surveillance Monitoring. Therefore, there is no need to re-visit off-site private drinking wells. Additionally, the extents of plumes on the NFSS with respect to past practices, partial surface-source removal by the Department of Energy, and the timeframes of plume development indicate that the upper water-bearing zone is not permeable enough to provide transport to far off-site receptors (Groundwater Model, Section 4.0, USACE 2007c). Plumes developed from on-site residue storage operations are generally limited to the source areas, with downgradient transport predominantly to the west and northwest.

Number	Comments	Response
146	(USEPA) Section 6.6.1, Page 6-9, 1st paragraph: It is unclear if the groundwater modeling considered the scenario where no maintenance is performed on the IWCS and the failure of engineering controls. Such scenario should be considered to determine the impact of the IWCS on the environment and the surrounding community when maintenance of the IWCS stops and engineering controls fail.	The RIR focuses on baseline conditions only, which assume perpetual maintenance of the IWCS. However, as stated in Section 6.6.2 of the RIR, three worst-case IWCS failure scenarios were evaluated by the groundwater flow and transport model (Groundwater Model, Section 4.5.2). These scenarios can be used to infer results of discontinuing maintenance and failure of the cap. In addition, the Corps is currently developing a failure analysis technical memorandum to address potential releases from the IWCS and will provide a detailed analysis of this 'no action' scenario in the FS.
147	(USEPA) Section 6.6.1, Page 6-10, top of page: It is unclear why only the dissolved concentrations were used to define the isoconcentrations (i.e., the shape and extent of the plume). This may be acceptable for the purpose of the BRA when assuming the water as a drinking water source (filtered water). However, addressing only the dissolved phase may not be sufficient (i.e., when irrigation is considered as an exposure route in the resident farmer scenario). Further, addressing only the dissolved phase may be insufficient to identify and delineate any potential groundwater plume. As such, the BRA should consider both the dissolved and the suspended phase (total) of radionuclides in groundwater. Also, the RIR should include figures to show any potential plumes associated with the suspended phase. It is prudent to understand the groundwater chemistry and explain the behavior of radionuclides in groundwater (e.g., why higher levels of radionuclides are found in the suspended phase than a dissolved phase or vise versa, and how the radionuclide solubility level changes based on the groundwater chemistry). Off-site groundwater monitoring wells may be needed should the findings identify a groundwater plume, whether suspended or dissolved, exiting the site boundary.	For metal and radionuclide site-related constituents, both total and dissolved concentrations were used to evaluate the existence of a groundwater plume (RIR, Section 6.6.1). However, only the dissolved concentrations were used to define iso-concentrations used in the groundwater model and presented in the RIR. This is partly due to the fact that RI groundwater samples were predominantly collected from temporary well points which, by their nature, can exhibit high turbidity. Samples for dissolved analysis were filtered in the field at the time of collection, removing much of the turbidity that apparently affected the total fraction sampling results. Dissolved concentrations were also used to define plumes during the RI because portions of a constituent in an unfiltered sample can be sorbed onto particulate matter rather than be dissolved in the groundwater. Additionally, the site water bearing units are not conducive to colloidal transport due to fine-grained media with low permeability values. Hence, dissolved fractions of constituents are more mobile in site groundwater than non-dissolved fractions. However, it should be noted that the Baseline Risk Assessment evaluated dose and risk from exposure to total concentrations of constituents in groundwater to ensure a more conservative assessment of potential risk to human health and to comply with specifications included in Risk Assessment Guidance for Superfund (EPA 1989). NFSS-specific groundwater chemistry was taken into consideration for the MINTEQ modeling that was performed as part of the geochemistry analysis (Groundwater Model, Appendix D).

Number	Comments	Response
148	(USEPA) Section 6.6.2, Page 6-10, 1st sentence: It would be beneficial if a sentence is added to list the considered four failure scenarios.	Although a reference to the worst-case IWCS failure scenarios might be helpful, it would not change the conclusions of the report. Results from the worst-case simulations are presented in Section 4.5 of the Groundwater Model.
149	(USEPA) Section 7.1.5, Page 7-3, groundwater: The BRA should also address the toxicity risk from uranium.	The Baseline Risk Assessment looked at the chemical toxicity of uranium independent of its radiological carcinogenicity. Assessment of the non-carcinogenic (chemical toxicity) properties of uranium can be found in Section 2 of the Baseline Risk Assessment.
150	(USEPA) Section 7.3.4, Page 7-12, groundwater: Total radium-226 (monitoring well GW313-747 exhibited 10.7 pCi/L) and radium-228 (monitoring well GW313-747 exhibited 70.4 pCi/L) concentrations in excess of the MCL were identified in EU 4 (see Table 4-99 and Table 4-113). This should be discussed in this section of the RIR. Further assessment of radium in EU 4 is necessary.	Total and dissolved radium-226 and radium-228 detection maps were forwarded to EPA, however the location of positive detection points were scattered so no plumes could be drawn. The occurrence and distribution of elevated levels of radionuclides, including radium-226 and radium-228, in various environmental media is discussed in the RIR (Section 5.3). For radium-228, there was a single elevated concentration value in Exposure Unit 3 and 4 groundwater, which does not indicate the presence of a groundwater plume. For radium -226 there were only two Exposure Unit 4 locations where groundwater concentrations exceeded background levels. The maximum total and dissolved groundwater concentrations for radium-226, radium-228, thorium-230 and thorium-232 in site-wide groundwater are all less than their respective drinking water standards. While the concentrations of radium-226 and radium-228 could increase in the future due to ingrowth from thorium, it is highly unlikely that this ingrowth would result in concentrations exceeding the 5 pCi/L drinking water standard for radium-226 and radium-228 combined. Further assessment of the nature and extent of groundwater contamination in the EU 4 area was conducted as part of the RIR Addendum field investigations. The results of this investigation will be included in the RIR Addendum (Section 4.4).

Number	Comments	Response
151	(USEPA) Section 7.3.7, Page 7-21, Groundwater Fate and transport Modeling, 2nd paragraph: The paragraph states, in part, "It is concluded that existing reported radium concentrations in EU 7/10 plume are less than the MCL now (considering both total and dissolved results)…". This statement may not be true as concentrations ranging from 5.35 to 126 pCi/L of total radium-226 and radium-228 were measured in EU 10. Also, the same consideration (e.g., total and dissolved) should be given to all radionuclides in all EUs.	A thorium-230 plume located near the site boundary in Exposure Unit 7/10 was evaluated for future risks due to ingrowth because it is feasible that radium concentrations in groundwater could increase in the presence of parent thorium isotopes. It was concluded that existing reported radium concentrations in the Exposure Unit 7/10 plume are less than the Maximum Contaminant Level now (considering both total and dissolved results) and the potential for ingrowth would not result in an exceedance over the next 1,000 years without the introduction of a secondary source of contamination. Radium-226 was identified as a radiological risk driver by the Baseline Risk Assessment, contributing 50% or more of the cancer risk in the modeled adult/child subsistence farmer scenario for exposure to soil. The RIT goes on to recommend further evaluation of the presence of radionuclides in groundwater during the FS. Total and dissolved radium-226 and radium-228 detection maps were forwarded to EPA; however, the location of positive detection points were scattered so no plumes could be drawn. During the development of remedial alternatives for the FS, groundwater concentrations will be compared to ARARs.

Number	Comments	Response
152	(USEPA) Section 7.3.10, Page 7-28, groundwater: Total radium-226 (monitoring well GW-TWP830-3502 exhibited 10 pCi/L, GW-TWP852-3568 exhibited 5.35 pCi/L, and GW-TWP856-3580 exhibited 11.3 pCi/L) and radium-228 (monitoring wells GW102-745, GW-TWP830-3502, GW-TWP831-3505, GWTWP853-3571, GW-TWP854-3574, GW-TWP856-3580, and GW-TWP858-3586 exhibited concentrations ranging from 8.59 to 126 pCi/L) concentrations in excess of the MCL were identified in EU 10 (see Table 4-104 and Table 4-118), This should be discussed in this section of the RIR and included in the plume figures. Further assessment of radium in EU 10 is necessary.	Total and dissolved radium-226 and radium-228 detection maps were forwarded to EPA; however, the location of positive detection points were scattered so no plumes could be drawn. The occurrence and distribution of elevated levels of radionuclides, including radium-226 and radium-228, in various environmental media is discussed in the RIR (Section 5.3). For radium-228, there was a single elevated concentration value in Exposure Unit 3 and 4 groundwater, which does not indicate the presence of a groundwater plume. For radium -226 there were only two Exposure Unit 4 locations where groundwater concentrations exceeded background levels. The maximum total and dissolved groundwater concentrations for radium-226, radium-228, thorium-230 and thorium-232 in site-wide groundwater are all less than their respective drinking water standards. While the concentrations of radium-226 and radium-228 could increase in the future due to ingrowth from thorium, it is highly unlikely that this ingrowth would result in concentrations exceeding the 5 pCi/L drinking water standard for radium-226 and radium-228 combined.

Number	Comments	Response
153	(USEPA) Section 7.3.10, Page 7-28, Groundwater Fate and Transport Modeling: Be specific as to what will be the basis of using a different Kd during the FS (e.g., measurements to determine a site-specific Kd).	Site-specific values of K_d were obtained from testing soil samples from the R-10 pile and borehole BH-77 as reported in, *Geochemical Information for Sites Contaminated with Low-Level Radioactive Wastes* (Seeley and Kelmers 1984). A K_d value of 3.6 L/kg for uranium represents the average of the site-specific K_d values. Compared to published literature values of K_d, the site-specific average is low. Consequently, the K_d of 3.6 L/kg is conservative with respect to solute transport (i.e. low sorption). The Seeley and Kelmers report indicates that the testing methodology pertained to samples spiked with groundwater having a high uranium concentration. Therefore, these K_d values are most suitable where groundwater concentrations of uranium are high. The recommended approach for the NFSS is to assign the Seeley and Kelmers (1984) site-specific value where uranium concentrations are high, (e.g. within the IWCS); and use available collocated soil and groundwater data to estimate an average K_d value for the remaining portion of the site. There were numerous borings throughout the NFSS where saturated soil samples were collected along with groundwater samples. A K_d value was calculated using groundwater and soil data collected from the same borings. These data were used to calculate an average K_d value of 121 L/kg for uranium (elemental and isotopes) in the upper water-bearing zone.
154	(USEPA) Section 7.3.11, Page 7-32, Groundwater Fate and Transport Modeling: The modeling results should specify how far out south will the plume migrate off-site.	Based on the revised model using a new K_d, plume migration does not go south; it goes toward the north and northwest. However, due to the low permeability and low mobility associated with the radionuclides, large scale off site contaminant transport is not predicted by the model (i.e., it remains on site) (Groundwater Model, Section 4.5).

Number	Comments	Response
155	(USEPA) Section 7.3.17 (EU 17): This is a site wide EU for all media. It is unclear why only the groundwater media is addressed in this section. The remaining media (surface soil, subsurface soil, surface water, sediment, and pipelines are underground utilities) should be included in this section.	For the purpose of the RI and Baseline Risk Assessment, surface soil and subsurface soil, were evaluated on an Exposure Unit basis and were discussed in the summary section for each physical Exposure Unit (BRA, Section 5.4). In addition, in the Baseline Risk Assessment, exposure to all media and concentrations site-wide were also evaluated. The nature and occurrence of contamination found in the sediment and surface water of on-site interconnected drainage ways was evaluated as Exposure Unit 15 and the nature and occurrence of contamination found sediment and surface water in pipelines and subsurface utilities was evaluated in Exposure Unit 16. Groundwater was evaluated on a site-wide basis and was discussed in the Exposure Unit 17 summary section. It was not necessary to discuss the other media in this section as they were already summarized in the previous sections. The site-wide exposure point concentrations in Exposure Unit 17 were generally lower than what was estimated for the individual Exposure Units. Hence, it is more descriptive to draw conclusions about site contamination using the results from the individual Exposure Units, rather than on a site-wide basis.
156	(USEPA) Chapter 7: Under the "Recommendations" sections of each EU, USACE indicates the medium/media that needs further evaluation in the FS. It is unclear what the "further evaluation" will comprise, that is, does it mean evaluating alternatives of Action, No Action, and so on, or does the evaluation also include further investigations prior to evaluating the alternatives. Certain media (groundwater as an example), areas (on-site and off-site), and certain parameters (radium-226, radium-228, Cs-137, and Pu-239) need further assessment prior to evaluating alternatives in the FS. EPA recommends that USACE address such data gaps prior to evaluating the associated alternatives in the FS.	Following the review of comments received on the 2007 RIR, the Corps made the decision to produce an RIR Addendum that would address concerns and data gaps identified by written comments and in discussions held between the Corps and the public during public information workshops. RIR Addendum field activities focused on the collection of soil and groundwater data to refine the nature and extent of radiological and chemical groundwater plumes near the NFSS property boundary and in the vicinity of the IWCS. Additional tasks completed for the RIR Addendum will be explained in Section 2.2 of the RIR Addendum.
157	(USEPA) Chapter 7: It would help if the "Nature of Occurrence" sections for each EU, differentiated between chlorinated and non-chlorinated VOCs.	No differentiation was made between chlorinated and non-chlorinated volatile organic compounds and it is not clear how this would be helpful in a discussion of the nature and occurrence of contamination at the site.

Number	Comments	Response
158	(USEPA) Section 7.3.17, Page 7-48, 1st paragraph: The paragraph talks about the plumes located northwest and southwest of the IWCS. The plumes on the north and west of the IWCS should be addressed as well.	All plumes in the vicinity of the IWCS were discussed in Section 7.3.17 of the RIR. The text refers to plumes to the north-northwest and to the south-southeast of the IWCS which includes all of the plumes surrounding the IWCS, not just those to the northwest and southwest.
159	(USEPA) Section 7.3.17, Page 7-49, Groundwater Fate and transport Modeling, last paragraph: The paragraph states, in part, "It is concluded that existing reported radium concentrations in EU 7/10 plume are less than the MCL now (considering both total and dissolved results)... ". This statement may not be true as concentrations ranging from 5.35 to 126 pCi/L of total radium-226 and radium-228 were measured in EU 10. Also, the same consideration (e.g., total and dissolved) should be given to all radionuclides in all EUs.	A thorium-230 plume located near the site boundary in Exposure Unit 7/10 was evaluated for future risks due to ingrowth because it is feasible that radium concentrations in groundwater could increase in the presence of parent thorium isotopes. It was concluded that existing reported radium concentrations in the Exposure Unit 7/10 plume are less than the Maximum Contaminant Level now (considering both total and dissolved results) and the potential for ingrowth would not result in an exceedance over the next 1,000 years without the introduction of a secondary source of contamination. Radium-226 was identified as a radiological risk driver by the Baseline Risk Assessment, contributing 50% or more of the cancer risk in the modeled adult/child subsistence farmer scenario for exposure to soil. The RIR goes on to recommend further evaluation of the presence of radionuclides in groundwater during the FS. Total and dissolved radium-226 and radium-228 detection maps were forwarded to EPA; however, the location of positive detection points were scattered so no plumes could be drawn. During the development of remedial alternatives for the FS groundwater concentrations will be compared to “Applicable or Relevant and Appropriate” limits.
160	(USEPA) Editorial- Page xxxviii, EU 12, 2nd line: Replace “…central portion this EU…” with “..central portion of this EU…”.	Text revision refers to description for Exposure Unit 11, not Exposure Unit 12 as stated. Revision noted.
161	(USEPA) Editorial- Section ES. 9, Page xlvii, last paragraph: Delete the extra period “.” at the end of the paragraph.	Editorial change noted.

Number	Comments	Response
162	(USEPA) Editorial- Section 2.3, Page 1-2, 8th bullet: The more appropriate acronym for "Screening-Level Ecological Risk Assessment" is SLERA. Consider replacing SERA with SLERA.	Agree. Both terms are used in ecological risk assessments. While the term SERA will be retained in the RIR, the SLERA will be used in the future document such as the FS.
163	(USEPA) Editorial- Page 3-3, 4th paragraph: Replace "extend" with "extent".	Editorial change noted.
164	(USEPA) Editorial- Page 3-3, Section 3.2, 1st paragraph: Replace "horizontal and vertical datums" with "horizontal and vertical data". Also, replace "…surface and vertical datum…" with "..surface and a vertical datum…".	Editorial change noted.
165	(USEPA) Editorial- Page 5-28, 2nd line of 2nd paragraph: Replace "…gamma walkover or were random samples…" with "…gamma walkover or where random samples…"	Editorial change noted.
166	(USEPA) Editorial-Page 6-8, Section 6.6.1, subsection 1: Delete extra period "." at the end of the paragraph.	Editorial change noted.
167	(USEPA) Editorial- Section 7.1.5, Page 7-3, last paragraph: The more appropriate acronym for "Screening-Level Ecological Risk Assessment" is SLERA. Consider replacing SERA with SLERA.	Editorial change noted.
168	(USEPA) Editorial- Section 7.2.2, page 7-4, 2nd paragraph: Replace "strontium-190" with "strontium-90".	Editorial change noted.
169	(USEPA) Editorial- Section 7.3.16, Page 44, Relation to history: Replace "…that would were…" with "..that were..".	Editorial change noted.
170	(USEPA) Editorial- Table 3-7 and 3-18: Under the "Analyses" column, replace "exposives" with "explosives".	Editorial change noted.

Number	Comments	Response
171	(USEPA) It is inappropriate in the BRA to compare the detected contaminant concentrations to background concentrations when identifying site-related constituents. Recommended risk assessment policy does not provide for background comparison as a method to select contaminants of concern (COCs) in the human health or ecological risk assessment. The EPA recommended policy is to include all radionuclides and chemicals that exceed human health and ecological risk-based screening values in the risk assessment and discuss any comparisons to background in the Uncertainty Section of the report. This could result in the addition of radionuclides or chemicals to the list of site-related constituents and potentially increase the calculated values of the BRA.	Although the EPA-recommended policy does not include a screen against background levels, EPA does not require clean up to below background levels. If the exposure point concentration of a chemical or radionuclide (defined as the lower of the 95% Upper Confidence Limit of the data set and the maximum detected value) is below the upper tolerance limit of background, the background level is likely to be considered as a remedial goal and no further cleanup would be required.
172	(USEPA) The drinking water exposure parameters for the subsistence adult and child and the resident adult and child of 2.3 and 0.5 L/day are not recommended by EPA Region 2. An adult drinking water ingestion rate of 2 L/day and a child's ingestion rate of 1 L/day are the recommended values. The use of these values in the risk assessment calculations will change the cancer risk and non- cancer hazard index (HI) values (which are already greater than target levels) for the receptors potentially exposed to groundwater.	The Reasonable Maximum Exposure and Central Tendency Exposure drinking water ingestion values used by the Baseline Risk Assessment are based on 90th percentile and average water intake rates listed in Table 1.2 of the Exposure Factors Handbook (EPA 1997). These values were selected to bracket actual consumption rates and are not single point estimates. Since groundwater at the NFSS is of poor quality and low yield, groundwater is unlikely to be usable as a potable water supply, so it is likely that whatever value is selected to quantify intake from groundwater would overestimate actual exposures. In the FS, EPA recommended exposure values can be considered during any necessary refinements to our preliminary remediation goals.

Number	Comments	Response
173	(USEPA) The equation for the calculation of the PRGs for the subsistence farmer could not be found in the appendices of the BRA. EPA would like to check this equation so that a spot check of the PRGs can be performed.	The chemical risk-based Preliminary Remedial Goals were calculated according to the general methodology described in U.S. EPA's *Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals* (EPA 1991). The general form of the equation for cancer and non-cancer based PRGs is presented in Section 6.2 of the Baseline Risk Assessment. The PRG spreadsheets and exposure assumption tables were provided to the EPA for additional review.
174	(USEPA) For illustration purposes only, the upper water-bearing zone groundwater chemical concentrations should be compared to surface water screening criteria in the ecological risk assessment to determine if any potential exceedances may exist.	Since surface water data was compared to surface water screening criteria, it is not clear what a comparison of upper water-bearing zone groundwater to surface water criteria would illustrate. At the NFSS discharge of groundwater to surface water would only occur under saturated conditions when any groundwater that was discharged would be quickly diluted.
175	(USEPA) The SLERA contains 'a Weight of Evidence Assessment (Section 4.6) that attempts to understand the contexts of the risks based on various pieces of evidence and aims to "extend the separate findings from risk assessment towards the holistic view of risk management." Risk management is something that needs to be presented in a separate; document (e.g. Technical Memo or the FS) where the risk assessment results and other considerations (economic, future land use, community acceptance, etc.) are discussed and weighed to determine if remedial actions are necessary. Since this Weight of Evidence Assessment presents information for use in risk management decisions, it should be removed from this risk assessment report.	The Screening Level Ecological Risk Assessment results are intended to facilitate decision-making relative to the protection of the habitats and ecological receptors at the NFSS. A Scientific Management Decision Point is an important part of the Screening Level Ecological Risk Assessment. Given that it is a screening level process, it may not be conclusive regarding remedial actions. However, risk managers may use the Screening Level Ecological Risk Assessment information in conjunction with the human health risk assessment to determine if a weight-of-evidence evaluation of the screening results should be carried out. The weight-of-evidence assessment evaluates the technical information common to risk assessments in the context of broader topics such as significance of ecological resources, human-dominated land use, and trade-offs for chemical risk and physical or remedial risk. Eight weight-of-evidence elements were developed to weigh the NFSS Screening Level Ecological Risk Assessment quantitative results and other evidence. Together, the weight-of-evidence elements provide a holistic view and understanding of the ecological risk situation at NFSS.

Number	Comments	Response
176	(USEPA) There should be an explanation in the ecological risk assessment as to why carnivorous fish are not included as receptors of concern. It seems that the aquatic habitats at the site may not be suitable for fish survival but it is not stated specifically.	The discussion of human receptors (Section 2.2.2.1) states that fish consumption is not considered a complete exposure pathway because NFSS does not contain bodies of water capable of supporting game fish populations. This should have been repeated in the Screening Level Ecological Risk Assessment.
177	(USEPA) The statements presented in Section 4.2.1.1 Terrestrial Habitats need to be verified. The section states that areas of the site exhibit wetlands characteristics but their federal jurisdictional status has not been determined. The conclusion of the section is that "... no federally designated wetlands exist on NFSS (NYSDEC 2004)." It seems that wetlands delineation is necessary for the site to determine if federally regulated wetlands are present or absent.	Although the federal jurisdictional status of the onsite wetland areas has not been determined, a review of the Ransomville, New York Quadrangle NWI was conducted (BRA, Section 4.2.1.1). The New York Freshwater Wetlands Act of 1975 regulates wetlands 12.4 acres or larger in size. Smaller wetlands may be subject to protection if they are considered to be of unusual local importance. No wetland areas that meet the Wetlands Act of 1975 criteria were identified during a review of a wetland map. To follow up on this the Corps visited onsite wetlands and ditches in 2006 and scored them low, but noted that they are still functioning. It is important to note that the disturbed habitats in some NFSS areas are the result of past physical disturbance rather than the consequences of chemical or radiological contamination. While wetlands are present, they exhibit low scores because of their small size or physically degraded conditions.

Number	Comments	Response
178	(USEPA) The Baseline Risk Assessment addresses the on-site conditions and the potential migration of contaminant to off-site locations. There is a potential for the presence of contamination at vicinity properties, off-site underground utilities, and at outfall locations that are not addressed in the RIR or the BRA. The off-site areas should be investigated and the BRA revised or amended if deemed necessary.	Under the Formerly Utilized Sites Remedial Action Program (FUSRAP), the Corps is authorized to investigate the potential for radiological and chemical contamination due to past government activity on the 191-acre federally-owned NFSS and three open NFSS vicinity properties; Vicinity Property G, Vicinity Property E, and Vicinity Property E'. The investigation of contamination at vicinity properties in underground utilities or at outfall locations would have to be conducted by the Department of Energy. The Department of Energy recently completed "NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches" (DOE 2010), which reviews of all the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx Vicinity Properties E, E′, and G remain within the authorized scope of the NFSS project and these vicinity properties will be investigated by the Corps when other higher priority FUSRAP hazards are resolved and/or adequate funding is available to initiate new investigations concurrently with investigations already underway at the NFSS. A report of findings from the limited site investigation of Vicinity Property G was issued by the Corps in March 2009 (Tetra Tech, 2009). The Corps priority remains the long term remedy for the IWCS.

Number	Comments	Response
179	(USEPA) At other sites, when radium-226 or radium-228 are present, elevated levels of radon-222 and radon-220 where measured in people's homes due to site related contamination. At times, the contaminated material was brought indoors and reused in the house structures. Other times, the radon entered the homes via, cracks, unfinished floors, or basement sumps. Please, provide a justification why the radon pathway was not considered in the BRA given that radium-226 is the primary site contaminant.	The concern expressed for risks associated with the radon pathway is acknowledged. Risks associated with radon-220 and radon-222 are a major concern for alternatives involving the removal of residues and wastes from the IWCS, and these risks will be evaluated quantitatively in the FS. However, under current conditions, the concentrations of radon isotopes in air at the site are comparable to those measured at background locations in the area. The ability of the IWCS to contain radon-222 and radon-220 is monitored by the Environmental Surveillance Program (USACE 2009). Key components of the ESP that monitor the performance and integrity of the IWCS cap include: • *Radon-222 Flux Monitoring:* Annually 180 radon flux canisters are placed on the IWCS cap to measure the release of radon-222. • *External Gamma Radiation Monitoring:* External gamma radiation monitors are located around the IWCS and at the perimeter of the site to measure external gamma radiation dose rates. • *Radon Gas Monitoring:* Breathing zone air surveillance is conducted to determine the concentration of radon gas at NFSS. The results of this monitoring continue to show results well below regulatory limits or at or near background level demonstrating the effectiveness of the cap in reducing the release of radiation for the IWCS. During the FS, the Corps will evaluate risks associated with all radioactive contaminants at the site for the various remedial alternatives. The Nuclear Regulatory Commission has indicated that is not necessary or practical to demonstrate compliance with the 25 mrem/yr standard for unrestricted release for indoor radon exposures (10 CFR 20.1402). This is due to the wide variations in naturally occurring radon levels in houses in the country, and the various approaches that can be used to mitigate this risk. Rather, compliance is considered to have been demonstrated when the residual soil concentration of radium-226 meets the requirements for unrestricted release, without including the doses and risks from the radon pathway.

Number	Comments	Response
180	(USEPA) Page 1-2, Section 1.1: The strategy and objectives are tailored to address the contaminants with the NFSS site boundary and the potential for off-site contaminant migration. Depending on the results of future off-site investigations, the strategy and objectives may need to be expanded to include vicinity properties, underground utilities, and outfalls. Also, off-site groundwater monitoring and sampling is necessary as the groundwater modeling may not be appropriate for this application.	Under the Formerly Utilized Sites Remedial Action Program (FUSRAP), the Corps is authorized to investigate the potential for radiological and chemical contamination due to past government activity on the 191-acre federally-owned NFSS and three open NFSS vicinity properties; Vicinity Property G, Vicinity Property E, and Vicinity Property E'. The investigation of contamination at vicinity properties in underground utilities or at outfall locations would have to be conducted by the Department of Energy. The Department of Energy recently complete "NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches" (DOE 2010), which reviews of all the work that has been done on the closed vicinity properties. This document is available on the internet at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx Additional soil and groundwater sampling will be conducted in late 2009 as part of the RIR Addendum activities. Sampling will focus on select areas of the site where plume delineation is needed or where there is a potential for off-site migration of contaminants via groundwater. The results of investigation in these three areas will be included in the RIR Addendum (Sections 4.2, 4.3 and 4.5).

Number	Comments	Response
181	(USEPA) Page 3-3, Section 3.1.1, last paragraph: The paragraph discusses the finding of the hot rock about the size of a dime that contained over 800,000 pCi/g of radium-226 and similar elevated concentrations of other radionuclides. The paragraph then provides a justification that such results were not used in the risk/dose assessment because the rock was effectively removed. USACE needs to discuss the likelihood of similar rocks to be present in surface and subsurface soils at the site or consider including such results in the risk/dose assessment.	This rock was not representative of adjacent soils and was effectively removed through sampling. The associated results are not subject to risk/dose calculations. One of the general conclusions of the RI is that the occurrence and distribution of site-related constituents, especially radiological site-related constituents in soils, are very erratic and uneven (RIR, Section 5.0). Samples containing high concentrations of a given radionuclide were frequently located very near samples containing concentrations which were near or below background. Field gamma walkover data covered the entire NFSS property. Gamma walkover is particularly sensitive to gamma emitters (e.g. cesium, thorium and radium) and identified the hot rock in question. Gamma walkover results and analytical data support the conclusion that most of the elevated samples were collected from impacted areas that are small and isolated. Before the NFSS is closed out a final status survey will be conducted using Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The MARSSIM provides information on planning, conducting, evaluating, and documenting building surface and surface soil final status radiological surveys for demonstrating compliance with dose or risk-based regulations or standards. Since radium-226 was identified as a radionuclide of concern at the NFSS, it will be evaluated using the MARSSIM approach.
182	(USEPA) Page 4-13, Section 4.2.4.1, Section 4.2.4.1, Soil Dwelling Invertebrates Terrestrial Exposure Class: The fact that earthworms and other soil dwelling invertebrates serve as food items for insectivorous birds and mammals can be added to this section.	Agreed. The ecological relevance of soil-dwelling invertebrates, both as an important food item for birds and mammals and for their role in soil fertility has not been overlooked. This is the basis for the selection of earthworms as an ecological receptor species for the Screening Level Ecological Risk Assessment (BRA, Section 4.2.2).

Number	Comments	Response
183	(USEPA) Page 4-16, Section 4.2.4.2, Aquatic Biota-Eating Predator Exposure Class: An upper trophic level fish species is missing as a selected receptor of concern for this exposure class. There should be a discussion of the reason(s) why no fish are evaluated through the food chain pathway. This comment relates to the General Comment mentioned above.	Based on at least two ecological reconnaissance surveys of the NFSS ditches, there are no upper trophic level fish in the ditches. There is insufficient water in any of the ditches to support a fishery in the sense of two or more trophic levels. In other words, the few fish present are small and consist of one trophic level. The predators of these fish are represented by terrestrial piscivores such as the great blue heron, rather than bigger fish-eating fish. This approach addresses an upper trophic level and the possibility for biomagnifications, albeit as the existent great blue heron rather than a trout or bass. In the small amount of water available at the NFSS, the various aquatic organisms were grouped as the aquatic biota exposure class to represent the existing situation and not a theoretical food web from a text book.
184	(USEPA) Page 4-19, Section 4.3.2.1. Screening Steps for COPCs, Steps 2 and 3: Both of these screening steps state that HQs should be summed " ... separately for organic and inorganic COPCs to obtain HIs for soil, sediment, and surface water." EPA ecological risk assessment guidance recommends that all HQs be summed together to calculate a Hazard Index.	It was assumed that the toxicological endpoints for organic chemicals compared to inorganic chemicals were sufficiently different to justify separate Hazard Indices for each general type of chemical (BRA, Section 4.3.2.1). Regardless, it is acknowledged that a master chemical Hazard Index could be determined. This master Hazard Index can be summed from the individual Hazard Indices published in the Appendix C tables of the Baseline Risk Assessment.
185	(USEPA) Page 4-19, Section 4.3.2.1, Screening Steps for COPCs, Step 3: This step states that the lower of the RME or maximum concentration will be used to calculate average daily doses. EPA guidance recommends that the average concentration be used in the risk assessment calculations when the maximum concentration is not used (less conservative screening).	Because this is a Screening Level Ecological Risk Assessment rather than a baseline ecological risk assessment, it is appropriate to use more conservative dose statistics to calculate average daily doses. Use of the 95% upper confidence limit of the mean is more conservative than use of the true arithmetic or geometric mean and produces larger hazard quotients, which is proper for this stage of the analysis. Please identify the guidance document and page number where the average or mean is specified to be used in a Screening Level Ecological Risk Assessment instead of more conservative dose statistics, e.g., maximum and 95 % upper confidence limit of mean.

Number	Comments	Response
186	(USEPA) Section 4.3.2.3. Exposure Evaluation for COPCs: The ADD equations need to be revised to include parentheses around the BAFs or BCFs and the corresponding media/biota intake value.	Agree. The equations should have had parentheses around the Bioaccumulation Factors (BAFs) or Bioconcentration Factors (BCFs). However, computations were performed correctly and no new computations are needed.
187	(USEPA) Page 4-21, Section 4.3.2.3, Exposure Evaluation for COPCs: The ADD equation for terrestrial animals needs to be corrected; the term BCFa is present in the equation and BAFa in the definition of terms.	Agree. The term of BCFa in the equation should have been soil-to-animal Bioaccumulation Factor (BAFa). The variable was properly identified below the equation and the computations were performed correctly so no new computations are needed.
188	(USEPA) Table 2.2: There is no information on the source of the toxicity values used in this table. They should be included so that these values can be verified as the most up -to-date EPA approved values.	References for toxicity values were embedded in the table but were not displayed. A revision of Table 2.2 of the BRA will be presented in this RIR Addendum as Table 13-2.
189	(USEPA) Table 2.6: The resident child HI from ingestion of food items of 0.08 does not agree with the value of 0.8 presented on page 2-41. Please correct this discrepancy.	Noted. The correct resident child HI from ingestion of food is 0.08 as presented in Table 2.6. Editorial revision noted.
190	(USEPA) Table 2.7: The total RME ILCR for the construction worker presented here is 1.4E+02. The correct value should be 9.4E-04. Please correct this discrepancy.	Noted. The correct ILCR value is 9.4E-04 as stated in the comment. Table 2.7 is summing the wrong values. The correct value indicates lower risk levels and would not change the overall conclusions of the report.
191	(USEPA) Table 2.8: The subsistence farmer adult and child HI values from ingestion of food items of 0.1 and 0.3 do not agree with the values presented on page 2-45 (0.01 and 0.03). Also, the recreational adolescent HI from exposure to surface soil of 0.0004 does not agree with the value on page 2-47 of 0.0003. Please correct these discrepancies.	Noted. The EU 3 CTE HI values for a subsistence farmer adult and child HI exposed through the ingestion of food items presented on page 2-45 are one order of magnitude too low, they should have been recorded as 0.1 and 0.3. The HI for the recreational adolescent exposure to surface soil is off due to rounding. These changes do not alter the conclusions of the human health risk assessment.
192	(USEPA) Table 2.10: The surface water HIs for the construction worker and maintenance worker of 0.00005 do not agree with the values (0.00004) presented on pages 2-52 and 2-53. Please correct this discrepancy.	These discrepancies are due to rounding and do not alter the conclusions of the human health risk assessment. No revisions will be made.

Number	Comments	Response
193	(USEPA) Table 3.7 through Table 3.17: The footnotes state "Values are provided if the exposure pathway is identified as complete in the conceptual site model, otherwise "--" is shown". For all the receptors, sometimes either %-" is shown for risk with the associated dose or vise-versa. It is unclear how can the exposure pathway can be identified for the dose assessment and not identified for the risk assessment or vise-versa. Please revise or explain with justification.	This occurs only for the subsistence farmer and the resident scenarios which included both adult and child receptors. For these two scenarios, cancer risk was calculated on a time-weighted basis for adult and child receptors combined, however dose was calculated for adult and child receptors separately. The notation, "--", appears in the dose column where the time-weighted adult/child risk calculations were presented and in the risk column where adult and child doses were calculated separately.
194	(USEPA) Table 4.2: a) The management goals for both the terrestrial and aquatic populations and communities mention "... past MED activities"; this should be changed to NFSS instead. b) The decision rules for assessment endpoints 3, 4, 5, 6, 7, and 8 are missing text describing the outcome if the sum of fractions or sum of HQs is greater than 1. c) Assessment Endpoint 7 is missing the selected receptor of mallard duck.	Although a revision of Table 4.2 would be helpful, it would not change the conclusions of the report.

Number	Comments	Response
195	(USEPA) Table 4.3 through Table 4.11: Conservative wildlife exposure parameters need to be used in the calculation for average daily dose in a SLERA. In order to maximize the dose, the minimum body weight and the maximum ingestion rate for each selected receptor needs to be used. A review of these tables indicates that several average values (body weight, food ingestion rate, and water ingestion rate) were used instead of the most conservative values for the short-tailed shrew, red fox, red-tailed hawk, mallard duck, raccoon, great blue heron, and eastern cottontail. The American robin had its diet divided into a plant fraction and animal fraction of 50% each. In order to be conservative, the most contaminated dietary component, either plant or animal, should be used as 100% of the diet.	Exposure parameters were provided in the SERA work plan to show what values were going to be used. At that time, as well as when the computations were made, there was no attempt to use data that skewed the risk findings. Rather, a compendium by EPA was sought and the information was extracted in good faith as being representative of each particular receptor. Exposure parameters vary from species to species, from age to age on a given species, and even from location to location. Such variation could lead to slightly smaller HQs if larger organisms and faster-eating organisms are assumed or slightly larger HQs if smaller and slower-eating organisms are assumed. The range of HQs is expected to be small based on professional experience with this type of variability. Birds and mammals of a given species have similar weights, similar ingestion rates, and similar other traits. These similarities mean that a toxicant that was likely to cause risk to that particular ecological receptor would not be eliminated. That is to say, that numerical manipulation of the body weights, eating rates, and other traits is not likely to lead to false conclusions. The same is true of varying animal and plant fractions in the diet. In nature, animals like the robin, may eat all animals one season and all plants another season, depending on availability of that food. The robin's preferred food may not be available year round and the 0.5 for plant fraction and 0.5 for animal fraction was meant to represent this variability. It is anticipated that animal and plant fractions can influence HQs. For example, slightly higher HQs would be associated with toxicants bioaccumulated in animal food and when the plant food fraction is relatively low. Likewise, HQs would be slightly lower with toxicants that are not bioaccumulated in plants and animals, and when the ratios of animal and plant food are tilted one way or the other.

Number	Comments	Response
195 (cont.)		The environmental data and exposure assumptions used for the NFSS SERA are limited and subject to interpretation. The scientific uncertainties inherent in the SERA risk assessment process are acknowledged and discussed in Sections 4.5 of the BRA. However, the default exposure assumptions and other values were selected in a conservative manner and are not likely to under estimate risk to a receptor. Although modifying the exposure assumption mentioned by the comment may not have a substantive impact on the determination of whether and when a cleanup action should be taken, it would necessitate numerous minor revisions to the many calculations conducted for the SERA which could give the impression that the risk assessment is a more discerning scientific tool than may actually be the case. These revisions would require time to complete and may slow remedial progress at the NFSS. No computational revisions are recommended at this time.
196	(EPA) Throughout the more appropriate acronym for Screening-Level Ecological Risk Assessment is SLERA. Consider replacing "SERA" with "SLERA".	Noted. Screening-Level Ecological Risk Assessments are routinely referred to using both the "SERA" and "SLERA" acronyms. Since this revision has no effect on the document conclusions the term "SERA" will be retained in the Remedial Investigation Report (RIR, USACE 2007a).
197	(NYSDEC) Page 1-4, last paragraph: With respect to ARARs, New York state requirements should also be taken into account.	The FS will consider potential applicable or relevant and appropriate regulations (ARARs) including federal and state policies, guidelines, or rules developed to address potential risks similar to those documented for the NFSS.
198	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-4, Section 2.2.2.1. 1st paragraph: Why weren't recent soil borings by CWM (post 1993) or the Corps' FUDS contractor (EA Engineering) reviewed as part of the program?	When the groundwater modeling study was initiated, all available soil borings were reviewed as part of the program. This included nearly 700 borehole locations on the NFSS, Modern Landfill, and CWM properties, including more than 60 installed later than 1993. The locations for all soil borings are shown in Figure 2.8 of the groundwater modeling report (USACE 2007c).

Number	Comments	Response
199	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-6, Section 2.2.2.2. Figures 2.10, 2.11, 2.12: Although these Figures may be better presented as 3 dimensional animations on a computer, they do not translate well in two dimensions. Traditional Isopach or surface contour maps of the different unconsolidated deposits may better present the underlying geology.	Figures 2.10, 2.11 and 2.12 depict a three-dimensional view of the NFSS subsurface geology. These three-dimensional images complement the traditional isopach and contoured top surface maps which are presented in Figures 2.13 to 2.20. An isopach map is used to show the areal extent and thickness of subsurface geologic formations for underground structural analysis. Additional subsurface cross-sectional profiles will be developed for the RIR Addendum (Appendix 12-J, USACE 2010) to further explore subsurface stratigraphy near the IWCS and other locations where groundwater may be migrating off site.
200	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-7, Section 2.2.2.3.2, 3rd paragraph: When considering the distribution of sand lenses within the Upper Clay Till at the area of interest, the reader should understand the set of data used (as shown in Figure 2.8) and the focus of the study (NFSS).	Agreed. Figure 2.8 of the Groundwater Flow and Contaminant Transport Modeling Report illustrates the location of all boreholes where subsurface geologic data were used in the sand lens evaluation. Figure 2.14 presents borehole locations where sand lenses have been encountered within the Upper Clay Till. A detailed evaluation of the geology underlying the NFSS was completed based on information provided from over 700 boring logs created during drilling activities at the NFSS, Modern Landfill, and CWM properties. The elevations of subsurface geologic units were compiled into a site-specific database for this project. A summary of the station locations including boreholes, monitoring wells, piezometers etc. that were used in this project was provided in Appendix A of the Groundwater Flow and Contaminant Transport Modeling Report. A statistical summary of the lithologic data contained in the database is presented in Table 2.3 of the Groundwater Flow and Contaminant Transport Modeling Report (USACE 2007c).

Number	Comments	Response
201	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-11, Section 2.3.1. 1st paragraph: The term "statistically disconnected" with respect to sand lenses may be true in a statistical sense, but is better supported by field data.	A summary of the geostatistical analysis performed to evaluate sand lens continuity at the NFSS is presented in Appendix B of the Groundwater Flow and Contaminant Transport Modeling Report (USACE 2007c). The geostatistical analysis was based on available field data (lithologic descriptions). Historical cross-sections were also reviewed, and these also support the conclusion that the sand lenses are not spatially continuous over significant distances. Additional cross-sections will be developed for the RIR Addendum (Appendix 12-J) to further explore subsurface stratigraphy and sand lens connectivity near the IWCS and other locations where groundwater may be migrating off site.
202	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-11, Section 2.3.2: Please note that due to the limited amount of hydraulic conductivity data for the Glacio Lacustrine Clay unit, the power of the statistical evaluation is reduced.	Agree. The power of the statistical evaluation of hydraulic conductivity is reduced outside the NFSS where data is limited. However, data obtained from CWM and Modern Landfill was used to supplement the NFSS data and provides greater assurance of the lateral continuity of the stratigraphic layering observed at the NFSS. Collectively, between the NFSS, CWM and Modern Landfill properties, there were more than 700 boreholes from which the conceptual understanding was developed (Groundwater Model, Section 2.2.2.3, USACE 2007c). This amount of data is considerably more than is typically available for many model development efforts. As an additional measure to validate the values of hydraulic conductivity assigned to the model, NFSS water level data was used in the calibration process. Moreover, the assigned hydraulic conductivity values compare favorably with published literature (e.g. Freeze and Cherry 1979) for the lithology represented by each unit. Although there was limited borehole data away from the NFSS area, United States Geologic Survey (USGS) contours of regional groundwater flow were used to confirm that the regional calibrated flow solution was representative of observed conditions.

Number	Comments	Response
203	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-12, Section 2.3.6: Please note that some of the monitoring wells depicted on Figure 2.25 as Queenston Formation wells, are not screened in the bedrock (FP01D, F802LD, F102D, W202D, W1206D, Wl101D, W1103D. W1104D & W1105D).	For the purpose of groundwater model analysis, a borehole which penetrated the bedrock was assumed to be completed in the bedrock. According to available borehole records, the wells listed in the comment penetrate bedrock. Well completion and borehole information was retrieved for the wells in question. These are all CWM wells and can be found in "*Groundwater Monitoring, Sampling and Analysis Plan, Model City TSDR Facility, Model City, New York*" (Bechtel Civil and Minerals, Inc. 1989). It was confirmed that all monitoring wells are screened in bedrock, have hydraulic connection with the bedrock, or are within inches of the top of the Queenston Formation. These are deep wells, as indicated by the "D" in their names. All boreholes penetrate the Queenston Formation. In some cases, the screened interval is above the Queenston Formation, but the sand pack or caved materials extend below the Queenston Formation, indicating a hydraulic connection. There are two cases where the well screen is marginally above the Queenston Formation: F802LD (0.8') and W1206D (3'). A summary of the depths for each of the wells follows below (QFM = Queenston Formation). F102D – QFM at 37.1' BGS; bottom of sand pack at 40.7' BGS F802LD – QFM at 55' BGS; bottom of sand pack at 54.2' BGS FP01D – QFM at 50.3' BGS; bottom of sand pack at 52' BGS W1101D – QFM at 42' BGS; bottom of sand pack at 42' BGS (Note typographical error assumed Wl101D is W1101D) W1103D – QFM at 39' BGS; bottom of sand pack at 40.2' BGS W1104D – QFM at 44' BGS; bottom of sand pack at 44' BGS W1105D – QFM at 48.3' BGS; bottom of sand pack at 48.5' BGS W1206D – QFM at 44' BGS; bottom of sand pack at 41' BGS

Number	Comments	Response
204	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-14, Section 2.4.1, 2nd paragraph: Please explain what "semivariogram analysis" is and why it is useful in evaluating sand lens correlation.	A summary of the geostatistical analysis performed to evaluate sand lens continuity at the NFSS is presented in Appendix B of the Groundwater Flow and Contaminant Transport Modeling Report (USACE 2007c). To evaluate the degree of spatial connectivity (i.e., spatial continuity) of the sand lenses, the Corps conducted a semivariogram analysis. Semivariogram analysis is a geostatistical technique that is used to characterize and describe the spatial correlation of phenomena that are spatially distributed, or spread out. It provides the framework for most geostatistical analyses. A clarification of this concept will be presented in the RIR Addendum (Appendix 12-J).

Number	Comments	Response
205	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-17, Section 2.5.1, last paragraph. Figure 2.28: • Does the Corps realize that several of the wells on the CWM property used to create Figure 2.28 are part of groundwater extraction systems? • It is not understood why a wider number of monitoring wells on the CWM property, measured on October 17, 2000, were used to create this Figure (and other potentiometric surface maps). • Why are water level measurements from only one year (two events) reviewed when water level measurements have been taken annually for several years? Multiple years of consistent flow directions creates a much more compelling argument.	The Corps was aware that several of the CWM wells used to create Figure 2.28 were being used for groundwater extraction at the time the model was developed. Pumping at these wells was not included in the model because field observations demonstrated that extraction from CWM wells did not have a measurable effect on local water levels. Water level contours presented in Figure 2.28 of the Groundwater Model are limited to wells for which (a) water levels were monitored; (b) x/y coordinates were available; (c) the screened interval was available; and (d) geologic information was available (to determine the screened unit). Wells lacking any of the above information were not included in the water level plots. Multiple years of water level data is available, but for presentation purposes the average water level from four monitoring events spanning two years was calculated. Thus, this 2-year data set includes 4 water level values for every point shown. Extending the data set further back to include more years would have limited available points where an equal number of water levels had been measured. Variability in the number of water levels may introduce localized bias. Thus the data presented is equally weighted between all four periods, with the trade-off that it is only 2-years worth of data rather than more. As an additional measure of assurance, the 2-year water level average was compared to historical long term averages and confirmed to be consistent.

Number	Comments	Response
206	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 2-21, Section 2.6, 2nd paragraph: Water budgets are conducted by CWM (and possibly Modern) annually. In addition, CWM has an on-site weather station.	The Corps was not aware that annual water budgets were prepared at the CWM and Modern landfills. Only water budget studies presented in Section 2.6 were available for review during the modeling analysis. For modeling purposes, historical meteorological data were obtained from National Oceanic Atmospheric Administration records for the local Lewiston weather station. Precipitation was not directly entered into the model, but instead provided a reference value to guide model calibration of values of groundwater recharge. Local CWM-measured precipitation would provide more localized data, but the extent of available historical records and accuracy or quality assurance of the CWM data is not known. Nevertheless, the Lewiston station is within reasonably close proximity for the data to provide a sufficient level of accuracy for calibration. Obtaining CWM data would, therefore, not materially change the calibration procedure or otherwise add value to the project objectives.
207	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 3-1, Section 3.2: Finite difference modeling was performed by CWM in the mid-1980's and in 2002.	Reports documenting the finite difference modeling conducted by CWM in the mid-1980s were not available during the initiation of the regional model development. Given the available computing resources in the 1980's (pre- IBM XT era) the modeling performed then would be somewhat rudimentary.
208	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 3-7. Section 3.3.3.2, Figure 3.4: Please provide information on the selection of recharge areas. Especially the swampland ponded water depicted on the eastern side of the IWCS.	Precipitation-recharge areas were selected on the basis of land use/land cover data as reported in the EPA "Basins" database. The assigned areas shown in Figure 3.4 of the Groundwater Model reflect the underlying grid resolution and may overlap with known land use features (e.g. the swampland/ponded water assigned to represent the Central Drainage Ditch overlaps with the main road leading past the entrance gate).
209	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 3-13. Section 3.4.3.1, 1st paragraph: Was the zonation of hydraulic conductivity based on field data, or to make the model "fit" water level measurements?	The zonation of hydraulic conductivity was based on contoured field data as presented in Figure 3.4 of the Groundwater Model. The value of hydraulic conductivity in each zone was adjusted by up to 10 times the original value.

Number	Comments	Response
210	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 3-14. Section 3.4.3.2, 3rd paragraph: The text states: "...the model tends to over predict the hydraulic heads near the Central Drainage Ditch..." Could this be related to the selection of this area as a "recharge area" (as shown on Figure 3.4)?	No, although the area near the Central Drainage Ditch was assigned as a recharge zone, the Central Drainage Ditch itself was prescribed as a drain boundary condition in the model. The model-predicted hydraulic heads near the Central Drainage Ditch are high relative to the target values which define a localized depression in the potentiometric surface near the Central Drainage Ditch. The cause of the over-prediction could be due to a variety of reasons including: 1) model assigned hydraulic conductivity values that are too low in this area; 2) a recharge value that is too high for this location; 3) a drain elevation that is too high; or 4) a drain conductance that is too low. Although the model simulates hydraulic heads in this area that are slightly higher than observed hydraulic heads (~2 feet), the model does a good job simulating the general flow patterns in the area of the NFSS within the seasonal range of the heads.
211	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 4-15, Section 4.3.2.1, last bullet on excluding constituents: Does this statement mean that if a constituent is not widespread, its transport is not modeled? What if a constituent is in one isolated area and in high concentrations?	The model is not intended for high-resolution simulation of small scale features, in this case, single point concentrations. The model is designed to provide regional predictions on the order of years, decades and millennia. Therefore, if a constituent was present at high concentrations but its occurrence was not widespread, it would have been excluded from the simulations.

Number	Comments	Response
212	(NYSDEC) Groundwater Flow and Contaminant Transport Modeling Report Page 4-29, Section 4.5: It is not clear from the simulations, whether the model considers groundwater discharge to surface water (Central Drainage Ditch, West Ditch).	The groundwater model provides a prediction of water and solute discharge into four drainage ditches on the NFSS: the Central, West, South-16 and South-31 Drainage Ditches. Relevant modeling results include: • Among the four drainage ditches, the highest average flow rate was predicted for the Central Drainage Ditch. • The lowest predicted flow rate was for the South 16 Drainage Ditch. • Of the four drainage ditches analyzed, the highest diluted uranium-238 concentrations are predicted to occur in the South 16 Drainage Ditch, originating from sources in Exposure Units 8, 11 and 12. • Uranium-238 screening level exceedances are predicted to occur in the South 16 and South 31 Drainage Ditches after 350 years. • Screening level exceedances, based on diluted flow concentrations, are not predicted to occur in the Central or West Drainage Ditches. A discussion of the model results for groundwater discharge to surface water will be included in the RIR Addendum (Appendix 12-I).
213	(NYSDEC) Page xxxv, Section ES.4 1st paragraph: Change "...and on the northwest by the village of Lewiston" to "... and on the northwest by property owned by the town of Lewiston".	Editorial comment noted; however, minor editorial revisions to the RIR documents will not be addressed since such corrections will not substantially change the conclusions of the report.
214	(NYSDEC) Page xli, Section ES.4 Surface and Subsurface Soil, 1st paragraph: A description of the "sealing" of the pipeline utilities extending off-site should be provided if available. If documentation is not available, the sealing of the pipelines should be field confirmed (and sealed if not).	The sanitary sewer and acid lines extending from NFSS to CWM were plugged by the Corps in 2006. In addition, the LOOW acid waste sewer and sanitary sewer lines were plugged in the area just north of M Street as part of the consent order issued by NYSDEC in 1978 to SCA, (the predecessor of CWM).

Number	Comments	Response
215	(NYSDEC) Page xli, Section ES.6, Groundwater, 1st paragraph: The term "plume" should not be used to describe the presence of radionuclides, metals or organic compounds in the groundwater. Insufficient data is presented in the report to substantiate the areas of elevated groundwater contaminants (as depicted on the Figures of Section 5) and appear to be a figment of computerized contouring of data and not representative of actual field conditions. This is not an acceptable and responsible method to present groundwater information.	Although the configuration of contamination in groundwater at the NFSS may be irregular rather than uniform, as depicted by a classic uniform plume, contaminated groundwater areas at the NFSS were referred to as "plumes" in the RIR for the purpose of evaluating constituents present in groundwater (RIR, Sections 5.1.1 and 5.1.2). The extent of groundwater plumes was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. Several plumes were defined by only two or three data points. This method for groundwater plume delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated. Information regarding contaminant transport via groundwater is available in the NFSS Groundwater Flow and Contaminant Transport Modeling Report (USACE 2007c). As the CERCLA process continues for the site, the broader “plumes” will be redefined to ensure small-scale sources or impacts are not assumed as widespread. Additional soil and groundwater sampling was conducted in late 2009 as part of the RIR Addendum activities (RIR Addendum, Section 3.0). Sampling will focus on select areas of the site where plume delineation is needed or where there is a potential for off-site migration of contaminants via groundwater. This investigation will cover three areas of interest and the results will be included in the RIR Addendum (Section 4.0).

Number	Comments	Response
216	(NYSDEC) Page 1-4, Section 1.5, 5th paragraph: NYSDEC comments on the 1986 DOE Record of Decision include the Department's (NYSDEC's) position that shallow land burial (such as the waste containment structure) is not appropriate for the K-65 waste. The Department considers the K-65 waste to be "Greater than Class C" material.	Greater than Class C material contains concentrations of radionuclides that exceed the limits for Class C Low Level Waste as defined by the Nuclear Regulatory Commission (NRC) in the Code of Federal Regulation 10 CFR 61.55. Greater than Class C material is generated in the commercial sector by activities under NRC or NRC-licensed Agreement State over sight. The applicability and/or relevance and appropriateness of this statute will be examined for the K-65 waste and other IWCS materials. The Corps conducted a preliminary evaluation of potential Applicable or Relevant and Appropriate Requirements (ARARs) that may provide the statutory basis for managing the NFSS wastes. ARARs under consideration for NFSS include but are not limited to 10 CFR Part 40 Appendix A and 40 CFR Part 192 Subparts A, B, and C.
217	(NYSDEC) Page 1-5. Section 1.5, 1st paragraph: It is the Department's (NYSDEC's) understanding that Building 403 was used as a firehouse not a laboratory and office building. Please clarify.	Section 1.5.1 of the RIR describes Building 403 as the Main Fire Headquarters, which formerly housed the site's fire protection services, and states that it was demolished in 2000. A laboratory and offices were also maintained in this building. The LOOW Completion Report (White Engineering 1943), which includes Building 403 construction records, will be provided in an RIR Addendum (Appendix 12-B).
218	(NYSDEC) Page 1-5, Section 1.5.1, Baker-Smith Area: It is the Department's (NYSDEC's) understanding that the Baker Smith area was used for warehousing, a pipe shop and other "hand-shops".	During operation of the LOOW, a pipe shop, machine shop, welding shop, and store house were located in the Baker-Smith area near a rail line that ran roughly parallel to West Patrol Road. Section 5.2 of the RIR describes the Baker-Smith Area in greater detail. The LOOW Completion Report (White Engineering 1943), which includes Baker-Smith Area construction records, will be provided in an RIR Addendum (Appendix 12-B).

Number	Comments	Response
219	(NYSDEC) Page 1-6, Section 1.5.1, Power Area: It should be mentioned that Building 401 was originally a coal fired, steam plant with coal storage located on the south side of the building.	Section ES.5 of the RIR states that "during the operation of the LOOW, Building 401 served as a power house, generating steam for use in the TNT production facilities. Later, the building housed a boron-10 (a non-radioactive isotope) separation process." Although no explicit statement is made regarding coal storage at Building 401, this does not significantly alter the statement of process knowledge that was made in Section 1.5.1. The RIR Addendum will include the LOOW Completion Report (White Engineering 1943), which includes Building 401 construction records (Appendix 12-B).
220	(NYSDEC) Page 1-6, Section 1.5.1, Freshwater Treatment Plant: Given the importance of the current status of the former water treatment plant for the storage of residues, much greater detail of the design, operation and use of treatment plant units/buildings should be provided.	Information thought to be relevant to the current status of the buildings' use for residue storage was included in the RIR. If needed, additional detail of the design, operation and use of treatment plant units/buildings will be included in the FS. Construction records for the freshwater treatment plant from the LOOW Completion Report (White Engineering 1943) will be provided in an RIR Addendum (Appendix 12-B).
221	(NYSDEC) Page 1-6, Section 1.5.2: The materials originally "stored" in Building 411 and the Baker-Smith Area should be identified and listed in the report.	Section 1.5.2 of the RIR covers all materials that were stored at NFSS and identifies where they were stored on-site. Restating this information in a different format would be redundant and unnecessary.
222	(NYSDEC) Page 1-9, Section 1.5.2, Other Wastes: Other operations and materials stored at the site (fuel rods, cesium "caps", uranium billets, "new naval waste area") should be included in discussions of historical operations.	Section 5.3 of the RIR includes a reference to uranium rods stored in Buildings 431 and 432 located near the boundary between Exposure Units 3 and 4. The RIR also describes widespread cesium contamination of environmental media at the NFSS; however, it is unclear what is meant by cesium "caps". Should this have been cesium "gaps"? The KAPL materials included electron tubes (called "gaps") that could have been a source for cesium-137 contamination. Uranium billets are discussed in Section 5.5 of the RIR which includes a description of the shops area in EU 8. The New Naval Waste Area is part of Exposure Unit 3 and is described in the RIR in several locations including Section 5.2. Since these radiological materials are discussed where they were handled, there is no need to repeat this discussion in Section 1.5.2.

Number	Comments	Response
223	(NYSDEC) Page 1-9, Section 1.5.3.1: The results of the 1970 Atomic Energy Commission radiological survey may not have been sufficiently sensitive, given that the detector was located one meter above the ground during the survey.	The 1970 Atomic Energy Commission radiological survey was used as a screening technique and has little impact on the delineation of impacts actually on the NFSS property. This survey of the former LOOW site performed using hand-held survey meters was used as a field screening technique to locate higher than "background" concentrations of radioactivity and to select soil sample locations. This information was used as the basis for off-site removal actions conducted at the vicinity properties. These actions included the removal of materials from the Central Ditch and Six Mile Creek beyond the boundaries of the NFSS.
224	(NYSDEC) Page 2-3, Section 2.2.3: Given that 444 documents and records associated with past construction, waste storage and remedial activities were reviewed to generate this section, three pages of findings is insufficient. Much greater discussion on historical information should be presented.	Although hundreds of documents were reviewed, only those that were particularly germane to the investigation are presented here. Information from many of the other documents is cited throughout the report. Appendix D of the RIR contains more detailed information about the reports reviewed as well as scans from some of the most important documents. The RIR Addendum will also include the LOOW Completion Report (White Engineering 1943), which includes historic construction records for many of the structures formerly located at the NFSS (RIR Addendum, Appendix 12-B).
225	(NYSDEC) Page 2-11, Section 2.3.6: Why does this report use meteorology data from Niagara Falls Air Force base when the groundwater modeling report uses data from Lewiston?	The meteorological data presented in the RIR was used solely as background information, whereas the meteorological data presented in the groundwater model was used quantitatively. To gain more accurate information, the groundwater model used data from four meteorological stations near the NFSS including the Buffalo International Airport, the Niagara Falls International Airport in Lewiston, New York and Modern Landfill. This was necessary to obtain a complete precipitation data set over an extended time period.
226	(NYSDEC) Page 2-13, Section 2.4.1: Is General Engineering Laboratories ELAP certified?	Yes, General Engineering Laboratories is an Environmental Laboratory Accreditation Program (ELAP) certified laboratory.

Number	Comments	Response
227	(NYSDEC) Page 3-3, Section 3. 1, Table 3-2: The sample naming convention is illogical. Linking the EU to the sample name would make data review much simpler.	The sample naming convention used in the RI was based on the site-wide investigation and used a sequential numbering methodology. During development of the RI, the exposure unit boundaries were adjusted and a sample numbering scheme linking the exposure unit number would have become unmanageable. In addition, data management during the FS will be on an operable unit basis rather than an exposure unit basis.
228	(NYSDEC) Page 3-4, Section 3.2.1: Were efforts made to tie the topographic survey to surveys of CWM and/or Modem Landfill? The top paragraph on the page discusses areas of settlement on the IWCS cap noted during the 1999 survey. Please provide a figure showing these locations.	A review of archival aerial photos was completed as part of the historic site assessment and is included in Section 1.5 of the RIR. The NFSS historic site assessment did not include topographic survey information for adjacent properties; however, review of archival aerial photos was conducted for the LOOW. Some minor settling of the IWCS cap has occurred, primarily in the area of the original R-10 pile. Most locations that experienced settling only reduced in elevation by an inch or less. Localized areas of settling greater than one inch occurred around the area where approximately 60 drums containing contaminated soils and resin, 4 steel tanks, approximately 900 boxes of soil samples, tarps, geo-textiles, and other miscellaneous debris were added to trenches cut into the IWCS in 1991. The maximum difference in elevation between the 1996 and 1999 surveys was 1.9 inches. The degree of settling has been minor and does not require illustration. A recently completed topographic survey of the IWCS also indicates very little movement or settling of the clay cap. The results of this survey will be presented in the RIR Addendum.

Number	Comments	Response
229	(NYSDEC) Page 3-6, Section 3.3.2.3, last paragraph: Given the importance of underground utilities as potential migration pathways, a greater discussion of the non-intrusive geophysical survey techniques and findings must be included in the report.	A description of the non-invasive geophysical survey methods used during the NFSS RI is provided in Section 3.1 of the RIR with the results presented in Appendix C. Intrusive surveys of the utility lines indicate that no permeable bedding that could serve as a preferential pathway for contaminant migration or large-scale inundation were evident on the NFSS. The Remedial Investigation of Underground Utilities completed for the LOOW stated that trends in chemical concentrations across pipelines were not discernable in many locations, probably due to the fact that several pipelines were sealed to prevent migration within the lines. The report stated that the sealed sections of pipeline are, in effect, acting more as tanks (or storage devices), rather than open conveyances for contaminant migration (EA ES&T, September 2008). A Fact Sheet describing the findings of the Remedial Investigation of Underground Utilities completed for the LOOW is available on the web at: http://www.lrb.usace.army.mil/derpfuds/loow/loow-fs-uuri-2009-05.pdf.
230	(NYSDEC) Page 3-10, Section 3.5.2: Why was the site broken into six sectors for the gamma walkover survey when it was previously broken into 14 EUs? This inconsistency only adds to confusion when reviewing the results.	For the gamma walkover survey, the site was broken down into manageable portions by designating Survey Units. Survey Units were defined by the following criteria: physical boundaries (roads/ditches), global positioning satellite signal availability, and the size of an area. The gamma walkover survey is discussed in Appendix B of the RIR and in a detailed technical report, *Gamma Walkover Survey and Geophysical Survey of the Niagara Falls Storage Site, Volumes I and II* (SAIC 2003), which is available in the administrative record. Results of the gamma walkover survey were used to delineate exposure units and select sample locations in areas with elevated gamma readings. The exposure unit boundaries were drawn to simultaneously satisfy two conditions: (1) to investigate locations with similar contaminant histories and (2) to delineate exposure units sized to include a statistically valid numbers of samples. The proposed exposure unit boundaries were reviewed by NYSDEC prior to their use, and those at the northern property boundary were broken into additional exposure units based on NYSDEC recommendations.

Number	Comments	Response
231	(NYSDEC) Page 3-12, Section 3.6.2: New York State Department of Health considers surface soil to be the interval 0 - 2" for exposure (the RI used 0 - 6" as surface soil).	For assessment of chemical risk, NYSDEC defines surface soil as 0-2 inches below the vegetation root system. To assess radiological risk, NYSDEC defines surface soil as 0-6 inches below ground surface. The RIR/Baseline Risk Assessment defined surface soil as 0-6 inches below ground surface including the root zone excluded in the State of New York definition (RIR, Section 3.6.2). Although there is the possibility of including slightly more soil with the 0-6 inch definition of surface soil, the slight difference is not expected to have a significant impact on the identification of chemicals of potential concern or the calculation of exposure point concentrations.
232	(NYSDEC) Page 3-22, Section 3.10.2.3: Were the new permanent wells surveyed? Were wells installed in the LWBZ cased off to prevent "dragdown", prior to advancing from the UWBZ to the LWBZ?	All of the new permanent wells referred to in Section 3.10.2.3 of the RIR were surveyed and marked with tags that included USACE Buffalo District, the well identification number, month and year of installation, elevation at the top of the PVC casing, and the ground surface elevation. Due to the presence of a thick aquitard layer between the upper water-bearing zone and the lower water-bearing zone, as well as poor water production from the upper water-bearing zone, well casings to prevent “dragdown” were not considered necessary.

Number	Comments	Response
233	(NYSDEC) Page 3-25, Section 3.10.2.6: The report mentions that two site-wide water level measurement events were conducted (12/7/99 and 8/24/00). Is the data associated with these events presented somewhere?	The water levels in 69 temporary well points were measured on December 7, 1999, and water levels were recorded for 66 permanent monitoring wells on August 24, 2000. Although this data was not presented in the RIR, additional information regarding water levels and an interpretation and discussion of groundwater flow within and between the upper water-bearing zone and lower water-bearing zone of the NFSS is presented in Section 2.5 and Appendix F-1 of the Groundwater Flow and Contaminant Transport Model report completed by HGL (USACE 2007c). Water levels measured during 2000 that were used to create the potentiometric flow maps presented in the groundwater flow model will be included in the RIR Addendum (Appendix 12-H). The detailed evaluation of groundwater flow conditions within the hydrostratigraphic units underlying the NFSS was developed based on water level elevation data that were compiled and integrated into the site-specific database which contains over 15,000 water level elevations that were measured at the NFSS, CWM, and Modern Landfill sites. These data were collected as part of environmental characterization and long-term monitoring efforts that have been routinely completed at these sites over the past 20 years.
234	(NYSDEC) Page 3-25, Section 3.10.2.7: Were the temporary well points surveyed?	Yes, all well locations were surveyed, including the temporary well points.
235	(NYSDEC) Page 3-25. Section 3.10.2.10: Since the temporary well points were not developed prior to sampling, this may skew the metals and radiological analytical results due to turbidity.	Concur. Typically, samples from temporary well points were turbid and contained visible suspended soil particles. However, total (unfiltered) groundwater results were compared to total (unfiltered) background levels. Dissolved (filtered) groundwater data was handled in a similar fashion. Dissolved fraction groundwater data were used to delineate groundwater plumes (RIR, Sections 5.1.1 and 5.1.2) but, so as to not underestimate risk, total fraction groundwater data were used for the Baseline Risk Assessment (Section 2.1.2, USACE 2007b).

Number	Comments	Response
236	(NYSDEC) Page 3-38, Section 3.16.1.2: Is the source of the ten drums of solid Investigation Derived Waste, which were rejected by the disposal facility (WCS), known?	The material in these drums originated in two places. Most of the material came from the open Vicinity Property G on LOOW and the rest came from an area the Corps investigated for the potential presence of buried animals from the University of Rochester. This investigation was a separate effort and not part of the NFSS RI. A small amount of the material came from an area on Exposure Unit 1 where KAPL waste had once been stored. These drums were never shipped to Waste Control Specials. Waste Control Specialist notified the Corps that the waste's characterization data did not meet their waste acceptance criteria and that another disposal facility would have to be located for these drums. These drums are currently being stored on-site in Building 401 and will be properly disposed following waste characterization in 2009.
237	(NYSDEC) Page 4-1, Section 4.2, 1st bullet: Within the first bullet it states: "Numerous small chips of radioactive waste residue with elevated gamma readings were found near the ground surface in the vicinity of these trenches". It is my understanding in speaking with Corp representatives that these chips were collected upon discovery and surrounding soils were re-surveyed. This needs to be better documented in the report.	As stated, numerous small chips were believed to be present at or near the surface in the vicinity of trenches T802 and T808. Their presence was discovered through random gamma survey of the surface in the vicinity of the trenches to be installed. These chips were not sampled or drummed and it is believed that chips remain on the surface in this area. Field observations for trench locations T802 and T808 are reported in RIR Table 4-1, which describes these areas as having several slightly elevated gamma readings at or near the surface. Gamma walkover surveys are not used to designate areas that should be posted as Radiation Areas (e.g., area roped off and posted as a radiation area). Instead, a separate measurement using a µR/h meter, or similar meter, is used to measure what the exposure level would be at waist level. Only areas where results indicate the potential exposure level is 5 mrem/hr or more using a µR/hr meter, or similar meter, are posted as Radiation Areas. These areas near the trenches were not posted to limit personnel access, however, access to the entire NFSS is restricted and the site is posted as a radiological materials area.

Number	Comments	Response
238	(NYSDEC) Page 4-1, Section 4.2: Please note the information contained in Table 4-1 indicates several other "significant" findings in addition to those presented here.	Although all of the findings are not discussed in this section, the text states a summary of field observations from each trench is contained in Table 4-1 and shown on Figures 3-16 through 3-44 of the RIR.
239	(NYSDEC) Page 4-1. Section 4.3: Why weren't the analytical results from the drum, road core and railroad ballast used to determine site related contaminants? Couldn't these matrices contribute to site contamination?	In order to identify site-related contaminants, the concentration of contaminants in environmental media including soil, sediment, surface water and groundwater were compared to background values. No background values were established for the drum, road core, and railroad ballast samples because they are not naturally-occurring environmental media. To be thorough, these samples will be screened against surface soil background levels and risk-based limits in the RIR Addendum. It should be noted that the existence of radiological contamination in building core samples does not constitute a release to the environment; therefore, this data will not be grouped with site soils or other natural media.
240	(NYSDEC) Page 4-2, Section 4.3.1: It is not understood why a background data set could not be established for roadways and railroad ballast. Aren't there roads or railroads not impacted by the site? Or for railroad ballast, why not statistically evaluate the data set and look for outliers? For roadways, a simple review of the data would indicate results out of the expected range (such as 26 ppm of arochlor-1254 in sample RC-coreOl-3730 or 5.72 pCi/g of Pu-239 in RC-core3-3734).	Background levels of direct radiation were determined in all media of concern at sampling locations geologically similar to the site, but beyond the influence of the site or other anthropomorphic influences. The media of concern identified for the NFSS include soil, groundwater, surface water, and sediment. Background levels for building cores, roadways and railroad ballast were not established because these features do not occur in natural areas, so there are no naturally-occurring background levels for these media. To be thorough, these samples will be screened against surface soil background levels and risk-based limits in the RIR Addendum (Section 8.0). The remediation of roadway material and railroad ballast will be addressed, as needed during the FS, as part of the Balance of Plant operable unit. The demolition and disposal of Building 401 will be performed using funds received through the American Recovery and Reinvestment Act.

Number	Comments	Response
241	(NYSDEC) Page 4-2, Section 4.3.2: The uranium content seems elevated in the sample of Drum 1. Please provide additional details.	All available data on the two abandoned and deteriorated drums found on the ground surface in Exposure Units 2 and 4 are presented in Section 4.3.2, Appendix AA or Table 4-3 of the RIR. No suitable background data set was available for these matrices; however, the analytical results were used to determine the appropriate disposition of the drums.
242	(NYSDEC) Page 4-2, Section 4.4.1: Because the first reference to an actual number for specific Background Screening Value was found in Table 4-20, it is suggested that within the written text of the document that a listing of background screening values for chemicals be placed in the chemical section and background screening values for radionuclides be placed in the radionuclide section. It might even be helpful if these lists were on separate pages so that they could be removed from the document, making it accessible upon further reading.	Noted. RIR Tables 4-5, 4-34, 4-65 4-88 and 4-95 present summary statistics for both chemical and radiological background levels in various environmental media. Background data summary tables for all environmental media at the NFSS are presented in Table 2.1 of the Baseline Risk Assessment. However, minor editorial revisions to the RIR documents will not be addressed since such corrections will not substantially change the conclusions of the report.
243	(NYSDEC) Page 4-5, Section 4.4.1. 2nd bullet: Was the railroad bed near the monitoring wells in question sampled to support the hypothesis proposed for the elevated Uranium in samples from these wells?	Railroad bed materials were not sampled near the two background monitoring wells (PZ-21S and PZ-25S) determined to contain outlier levels of total and dissolved isotopic uranium. However, not only did these two samples have unusually high concentrations of uranium isotopes, they also had uranium isotopic ratios indicating that they may have been impacted by site contaminants (Rhodes et al 2006 http://www.wmsym.org/abstracts/2006/pdfs/6350.pdf). The samples were removed from the background data set both on the basis of outlier levels of total and dissolved isotopic uranium and lower uranium isotope ratios. All groundwater results from these two wells were below drinking water standards.

Number	Comments	Response
244	(NYSDEC) Page 4-5, Section 4.4.1, 5th and 6th bullets: The appropriateness of the background locations for surface water and sediment needs to be reviewed considering that they are not upgradient/ upstream/ upwind of the site (and the R-10 pile was uncovered for years).	The locations selected for surface water and sediment background sampling were considered to be representative sampling locations because they are close to the NFSS and are presumably unimpacted by LOOW or NFSS site-related activities. A summary of the background surface water sample locations, rationale for selection, sample designations and analysis parameters are presented in Table 3-11 of the RIR. Rationale used for the selection of analytical parameters for each sediment sampling location is provided in Tables 3-12 through 3-14 of the RIR. The potential for R-10 related contamination and an interconnection between groundwater and surface water in the West Drainage Ditch will be investigated as part of the RIR Addendum (Sections 4.5 and 9.0).
245	(NYSDEC) Page 4-6, Section 4.4.1, Statistical Evaluation: Due to the limited amount of background data, the power of the statistical evaluation is diminished. Therefore, the determination of Upper tolerance limits may be questionable and should be used with caution.	The background screening value, referred to as the upper tolerance limit, was defined to be the lesser of the 95% background upper tolerance limit and the maximum value detected in the background data set (RIR, Section 4.4.1). Under general statistical guidelines, a total of eight samples are necessary to develop upper tolerance limits. At the NFSS, 16 surface soil, 34 subsurface soil, 28 groundwater, 10 sediment and 10 surface water samples were used. Prior to performing calculations using the medium-specific background data sets, outliers within the data set were identified using a simple inter-quartile test. Potential outliers were removed from the data set resulting in lower data set variability and a more reliable 95% upper tolerance limit.
246	(NYSDEC) Page 4-7, Section 4.4.2: It is understood that statistical evaluation of data can be powerful. However it can also be confusing. Simpler methods for selecting site related contaminants of concern should also be presented (such as process knowledge, site use, historical information).	Statistical methods were used to determine site-related constituents because statistical methods eliminate the bias simpler methods might introduce. A review of historical site records was conducted as part of the RI and references to process knowledge, site use and historical information appear throughout the report.

Number	Comments	Response
247	(NYSDEC) Page 4-9, Section 4.5: The use of the correct units for Uranium should be carefully observed. For uranium analysis on liquid media pCi/L or µg/L can be used depending on the purpose of the analysis and standard being compared. However, for soils or sediments the units have to be reported as pCi/g. This comment is applicable to all soil/sediment sample results.	Total uranium in soil/sediment was reported as mg/kg or µg/g rather than pCi/g because this was a total metals analysis. Isotopic uranium was reported as pCi/g because this was an assessment based on activity. The data was compared to results reported with the same units so no unit conversion was needed.
248	(NYSDEC) Page 4-10, Section 4.6.1.: With respect to naturally-occurring inorganic compounds, it is not advisable to "pool" data from different strata; or to mix surface soil data with subsurface soil data.	The Baseline Risk Assessment assumed that receptors exposed to subsurface soil (e.g. construction workers) would first be exposed to surface soil. To increase the statistical power of the background determination and to be consistent with the exposure assumptions of the Baseline Risk Assessment, all surface and subsurface soil samples were combined to form the background subsurface data set. Only surface soil data (0 - 0.5 ft) was used to determine the surface soil background value. Additional discussion concerning background characterization is provided in the Baseline Risk Assessment (Section 2.1.2.2).
249	(NYSDEC) Page 4-11, Section 4.9.1: It is not advisable to mix data from different flow zones.	Background groundwater samples were collected at 26 locations along the boundary of the LOOW site and on the Modern Landfill property (12 in the upper water-bearing zone and 18 in the lower water-bearing zone). To increase the statistical power of the background determination and to establish one site-specific background value for groundwater, all upper and lower water-bearing zone groundwater samples were combined to form the background groundwater data set. Additional discussion concerning background characterization is provided in the Baseline Risk Assessment (Section 2.1.2.2). The RIR Addendum will include a statistical analysis of the upper and lower water-bearing zone statistics to assess similarity of the two populations (RIR Addendum, Section 6.0).

Number	Comments	Response
250	(NYSDEC) Page 5-2, Section 5.1.1, 2nd paragraph: If samples were collected from a ditch or drainage way, sediment is a proper term for the sample. Materials in-these locations are much more likely from migration and/or deposition during rainfall/runoff events.	Due to the impervious nature of soils at NFSS, some areas that are dry for much of the year occasionally accumulate water. Sediment samples collected from locations that are inundated less than half of the year were reclassified as soil samples to be consistent with exposure mechanisms considered in the Baseline Risk Assessment (RIR, Section 5.1.1).
251	(NYSDEC) Page 5-4, Section 5.1.2, 2nd paragraph: With the exception of the last sentence, this paragraph explains the distribution and migration characteristics of the site. However, the last sentence contradicts the reality of the hydrogeologic setting. As stated elsewhere in these comments, the use of the term "plume" is inaccurate and gives an exaggerated depiction of groundwater conditions and migration.	Although the configuration of contamination in groundwater at the NFSS may be irregular rather than uniform, as depicted by a classic uniform plume, contaminated groundwater areas at the NFSS were referred to as "plumes" for the purpose of evaluating constituents present in groundwater. The extent of the groundwater plumes was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. Several plumes were defined by only two or three data points. This method for groundwater plume delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated (RIR, Section 5.1.2). As the CERCLA process continues for the site, the broader “plumes” will be redefined to ensure small-scale sources or impacts are not assumed as widespread. Additional soil and groundwater sampling was conducted in late 2009 as part of the RIR Addendum activities (RIR Addendum, Section 3.0). Sampling will focus on select areas of the site where plume delineation is needed or where there is a potential for off-site migration of contaminants via groundwater. This investigation will cover three areas of interest and the results will be included in the RIR Addendum (Sections 3.0 and 4.0).
252	(NYSDEC) Page 5-4, Section 5.1.2, last paragraph: Bis (2-ethylhexyl) phthalate is a common laboratory contaminant and should have been addressed as part of data validation. Presenting a "plume" of this constituent is inappropriate and should not be presented.	All positive detections for bis(2-ethylhexyl)phthalate were addressed during data validation. Samples remaining after data validation contained bis(2-ethylhexyl)phthalate at levels equal to or greater than 10 times the amount measured in the associated laboratory blanks. Therefore, it is appropriate to retain these data points in the database.

Number	Comments	Response
253	(NYSDEC) Page 5-6, Section 5.2.1.1, 3rd bullet: The discovery of positive cesium-137 analytical results at several locations around the site needs to be explained. Cesium-137 has been shown, in some instances to result from global fallout settling in low laying areas, or as subtly mentioned on this page, in areas of former building foundations, inferring possible accumulated fallout off a roof drip edge or from KAPL waste being present. Plutonium-239 analysis should be performed to rule out the latter. In any event, a discussion should be presented highlighting potential sources.	Cesium-137 is a fission product with global distribution due to fallout from atmospheric testing of nuclear weapons; however, the concentrations of cesium-137 found at NFSS are higher than regional background and greater at depth than in surface soil. Thus, the concentrations and locations of cesium-137 detections at the NFSS are not consistent with what would be expected from atmospheric fallout. Therefore, KAPL waste is assumed to be the source of the cesium-137 contamination. The widespread nature of the contamination is being investigated. Historic documents provide some information about where fission product contaminated materials were stored on-site but it is not known with certainty if the materials remained solely in those identified locations (RIR, Section 5.9.4). Although the exact source(s) of cesium-137 are not clear, potential risks due to exposure to cesium-137 were quantified by the Baseline Risk Assessment. Cesium-137 was identified as a radionuclide of concern in several exposure units and will be assessed further during the FS (RIR, Section 7.3). Additional sampling and analysis for cesium and plutonium will also be conducted as part of the RIR Addendum (RIR Addendum, Sections 3.0 and 11.0).
254	(NYSDEC) Page 5-6, Section 5.2.1.1, 4th bullet: Were shallow soil sampling results consistent with the results of the gamma walkover survey (did the walkover survey detect contamination not identified by the soil sampling or visa-versa)?	Site-wide surface soil sampling results were generally consistent with the results of the gamma walkover survey. The gamma walkover survey conducted in 2001 was principally used to select soil sampling locations to investigate the horizontal extent of surface radiological activity observed during the survey (RIR, Appendix B).
255	(NYSDEC) Page 5-7, Section 5.2.1.1, 2nd bullet: Please define what is meant by "...exceedances of the background UTL by a factor of at least 10 were relatively few."	For both thorium-230 and radium-226, few samples exceeded the background upper tolerance limits by a factor of 10 or more.

Number	Comments	Response
256	(NYSDEC) Page 5-7, Section 5.2.1.1, third bullet: With respect to the distribution of cesium-137 detections in soil samples, it is not unexpected to have compounds present in a random fashion, especially considering the manner in which materials were stored and handled at the facility.	Noted.
257	(NYSDEC) Page 5-7, Section 5.2.1. l, 4th bullet: The value of the information presented in this bullet would be greatly enhanced if the locations, concentrations and identity of the detected compounds were provided.	Agreed. RIR Figures 4-2 and 4-3 summarize the occurrence of site related compounds in soil at Exposure Units 1 and 2 that are discussed in this bullet. Although references to the appropriate figures might be helpful, they would not change the conclusions of the report.
258	(NYSDEC) Page 5-8, Section 5.2.1.1. 1st bullet: This bullet provides only the bear minimum of information on the sampling results. Where were above background levels of radionuclides detected in the subsurface? What about metals? Volatile organics? The information presented is more appropriate for an executive summary rather than a presentation of the results of the investigation.	Due to the large number of samples taken at the NFSS and the number of constituents analyzed for, it was not feasible to include all of the information in the text. The RIR text and figures should be used in combination with the tables to understand the location and concentration of contaminants in site media.
259	(NYSDEC) Page 5-8, Section 5.2.1.1, second bullet: Please provide the identification numbers corresponding to the abandoned drum samples referenced in this bullet. Please provide specific information on the compounds which were detected in samples of the material within the drum and the soil beneath the drum. This information will allow the reviewer to better assess the statement in the report that the drum is not the source of compounds detected in the soil.	The results for Drum 01 can be found in Table 4-3 of the RIR. Table 4-21 shows the concentrations of site-related constituents present in the surface soil below the drum.

Number	Comments	Response
260	(NYSDEC) Page 5-9, Section 5.2.1.4, 1st bullet: Given the characteristics of the unconsolidated strata the groundwater samples containing elevated dissolved total uranium were collected from, it is more likely that the contamination exists in discrete areas and not as a continuous "plume". In order to substantiate the "plume" depicted in Figure 5-4, several additional groundwater sampling points containing elevated dissolved total uranium are necessary between and in the vicinity of the two wells used.	Although groundwater contamination at the NFSS exists in discrete areas, the available data was interpreted using the most conservative approach, delineating continuous plumes where isolated groundwater impacts may exist. This method for groundwater plume delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated. Additional investigation will be conducted in the vicinity of the uranium groundwater plume in Exposure Units 1 and 2 depicted in RIR Figure 5-4. This investigation will begin with an examination of soil boring logs and the results for CWM wells, if available, to locate potential sand lenses. Analytical results from temporary well points will then be used to optimize the location of permanent wells. Results of this additional investigation will be presented in an RIR Addendum (Sections 3.0 and 4.2).
261	(NYSDEC) Page 5-10, Section 5.2.1.4, 2nd bullet: Why does the report consider ten times the background upper tolerance limit as the criteria for determining impact to the groundwater? The purpose of the investigation is to characterize the different media. Often, just the presence of a constituent is sufficient to warrant additional investigation. This bullet is also inconsistent with the information presented in the 4th bullet, as cesium-137 is a radionuclide and it was detected in excess of 10 times the upper tolerance limit (non-detect).	Ten times the upper tolerance limit of background was used in the Remedial Investigation Report (RIR, USACE 2007a) as a benchmark value to discuss the large number of analytical results, not as criteria for determining the impact to groundwater (RIR, Section 5.2.1.4). All detections in groundwater were examined for identifying site-related constituents. The occurrence of cesium-137 in groundwater at Exposure Units 1 and 2 did not exceed 10 times the upper tolerance limit of background. The upper tolerance limit for cesium-137 in background groundwater could not be calculated because it was not detected in the background wells. Summary statistics for background groundwater are presented in Table 4-95. Cesium-137 was retained as a site-related constituent and was evaluated by the Baseline Risk Assessment (USACE 2007b) but was not identified as a radionuclide of concern for Exposure Units 1 and 2 groundwater.

Number	Comments	Response
262	(NYSDEC) Page 5-10, Section 5.2.1.4, 4th bullet: Please correct the first sentence to read: "Cesium-l37 was detected in groundwater at location MW 404A and GW810A....” The detection of cesium-137 in groundwater is of concern to this Department, and the investigation and characterization of the presence of cesium-137 in groundwater at this area was not sufficient. Simply making calculations on two individual sampling results does not answer the questions of why the contaminant is present. Are wells 404A and GW810A isolated areas exhibiting the highest levels of contamination or do other areas exist? Why did the resample of well GW810A not detect cesium-137? What was different? Does the Corps have a theory?	The typographical error for location GW810A is acknowledged (RIR, Section 5.2.1.4), however, the correction of this error will not substantially alter the conclusions of the RI regarding cesium-137 in groundwater at Exposure Units 1 and 2. Within Exposure Unit 2, groundwater samples were collected from four permanent wells and 11 temporary well points. The well locations mentioned in the comment (MW 404A and GW810A) were sampled during Phase 2 to further evaluate the extent of radiological parameters observed in groundwater at Exposure Unit 2. RIR Figure 4-20 shows that radionuclides were identified as Exposure Unit 2 site-related constituents in 10 of the 14 groundwater locations using total phase (unfiltered) samples collected from wells installed in the upper water-bearing zone. Wells 404A and GW810A had the highest levels of radiological contamination measured during Phase 2 sampling but are not isolated areas of contamination. It is not fully known why the re-sampling of GW810A resulted in a non-detect value for cesium. The turbidity of the first sample may have been higher since the sample was drawn shortly after well installation, which could result in higher suspended solids causing soil-based detections within the water sample. Although the source of cesium-137 in environmental media at the NFSS could not be fully explained, associated potential risks were evaluated by the Baseline Risk Assessment and cesium-137 was not identified as a radionuclide of concern for groundwater at Exposure Units 1 or 2.

Number	Comments	Response
263	(NYSDEC) Page 5-12, Section 5.2.2: Please see previous comments on the use of the term "plume".	Although the configuration of contamination in groundwater at the NFSS may be irregular rather than uniform, as depicted by a classic uniform plume, contaminated groundwater areas at the NFSS were referred to as "plumes" in the RIR for the purpose of evaluating constituents present in groundwater (RIR, Section 5.1.2). The extent of groundwater plumes was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. Several plumes were defined by only two or three data points. This method for groundwater plume delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated.
264	(NYSDEC) Page 5-16, Section 5.3.1.1, Trenches 411,412, 413: Why weren't parameters other than radiological parameters investigated? Doesn't the name "New Naval Waste Area" suggest the materials at the area were possibly associated with the Navy Interim Pilot Production Plant? Discolored materials and elevated PID readings were noted in all three trenches. Wouldn't this suggest other contaminants besides radionuclides could be present?	Parameters other than radiological parameters were investigated in Exposure Unit 3 (RIR, Section 5.3.1.1). Trenches 411, 412 and 413 were dug in areas of disturbed, but reportedly remediated, soil in the New Naval Waste Area. The trenches were located to investigate the presence of the former radium vault where bars of pure radioactive materials were reportedly stored at the western end of the acidification area; therefore, trench samples were investigated for radiological parameters only. Magnetic anomalies, photo-ionization detector readings and visual observations were noted during trench excavations and other soil samples collected within Exposure Unit 3 were analyzed for a variety of potential site-related constituents. A summary of site-related constituents identified for surface and subsurface soil in Exposure Unit 3 is presented in RIR Tables 4-22 and 4-37, respectively. The New Naval Waste Area was used to store demolition debris which may account for the elevated concentrations of polycyclic aromatic hydrocarbon compounds found in area soils and pesticides detected in groundwater. It should be noted that the exact location of the former radium storage vault was not identified.

Number	Comments	Response
265	(NYSDEC) Page 5-18, Section 5.3.1.1. 2nd bullet: It is not clear why the presence of ballast in the area leads the author to suggest that the ballast is responsible for elevated concentrations of radium-226 in soil samples. Was ballast noted in the samples? How does the ballast explain the presence of other contaminants detected in these samples?	The review of historic records has not been definitive as to the elevated radium found in surface soils and railroad beds. However, the use of phosphate slag containing significant quantities of Naturally Occurring Radiological Materials (NORM), including radium-226, for railroad ballast and general construction aggregate is widespread across the Niagara region. Another possibility for the presence of radium or other contaminants is from possible spills during the loading and unloading of railroad cars. The U.S. Department of Energy investigated areas of elevated radioactivity in Niagara County and found slag with elevated radioactivity present at 62 locations within the county. This was determined to be a phosphate slag material previously identified as cyclowollastonite. This slag material is attributed to the electrochemical production of elemental phosphorus using uranium-bearing raw materials which reportedly originated from the former Oldbury Furnace in Niagara Falls (see the U.S. Department of Energy "Results of Radiological Measurements Taken in the Niagara Falls, New York, Area (NF002), November 1986"). A data summary for railroad ballast and building and road core samples is provided in Table 4.2 of the RIR. The RIR Addendum (Section 8.0, USACE 2010) will include a characterization of RI building core, railroad ballast and road core samples and a comparison of these samples to surface soil background levels and risk-based limits.
266	(NYSDEC) Page 5-18, Section 5.3.1.1. 5th bullet: The report should also discuss the locations of the detections, not just state "frequently" or the "maximum concentration". Several locations had detections of PCBs above New York State cleanup standards.	Polychlorinated biphenyls (PCBs) were identified in the Baseline Risk Assessment as a significant constituent of potential concern in Exposure Unit 4. However, due to the large number of samples taken at NFSS and the number of constituents analyzed for, it was not feasible to include all of the information in the text. The RIR tables and figures should be used in combination with the text to understand the location and concentration of contaminants in site media.

Number	Comments	Response
267	(NYSDEC) Page 5-18, Section 5.3.1.1, 6th bullet: It should be noted that tetrachloroethene was detected at a concentration of 63 parts per million in boring SB415.	Tetrachloroethene was identified in the Baseline Risk Assessment as a chemical of concern in Exposure Unit 4 groundwater. However, due to the large number of samples taken at NFSS and the number of constituents analyzed for, it was not feasible to include all of the information in the text. The RIR tables and figures should be used in combination with the text to understand the location and concentration of contaminants in site media.
268	(NYSDEC) Page 5-19, Section 5.3.1.1, 5th bullet: Please clarify which sample number corresponds with which material sampled.	The maximum detected concentration of Aroclor-1254 was 714 µg/kg in surface soil sample SS4C001-618. The maximum detected concentration of Aroclor-1260 was 70,200 µg/kg in surface soil sample SS-DRUM07-3398. The 96 surface and subsurface soil sample locations in Exposure Unit 4 are presented on Figure 3-8 and the corresponding analytical data is presented in Appendix AA of the RIR. A summary of site-related constituents identified for surface and subsurface soil in Exposure Unit 4 is presented in RIR Tables 4-23 and 4-38, respectively.

Number	Comments	Response
269	(NYSDEC) Page 5-20, Section 5.3.1.2: Regardless of turbidity, elevated metals were present in the water sample. This implies that the contaminants are subject to suspension, transport and migration; and therefore a potential problem.	A three-dimensional groundwater flow and contaminant transport model was constructed for the NFSS (Groundwater Model, Section 4.4.1, USACE 2007c). The groundwater model was used to predict long-term, contaminant mass loading rates to the water table and to simulate the transport of the contaminants within the saturated zone (Groundwater Model, Section 4.5). For this effort all contaminants detected in groundwater were evaluated as potential site-related constituents. In addition to the groundwater model the Environmental Surveillance Program routinely collects total phase (unfiltered) and dissolved phase (filtered) groundwater samples from 18 onsite locations and analyzes them for a variety of parameters. In many cases, the elevated groundwater concentrations seen during the RI (especially for total-fraction data) have not been reproduced by the Environmental Surveillance Program sampling, indicating that turbidity from site disturbance that occurred prior to the RI sampling may have skewed groundwater results (USACE, 2009). The Environmental Surveillance Program groundwater monitoring will continue to ensure that contaminant transport and migration does not pose a risk to human health or the environment.
270	(NYSDEC) Page 5-21, Section 5.3.1.4: Review of the Section 5 figures depicting groundwater "plumes" leads one to believe groundwater migrates in several directions from the same location. This observation is an additional reason why the Department does not consider the Report's presentation of groundwater conditions is appropriate.	The groundwater model indicates that the predominant direction of groundwater flow is towards the west to north-northwest (Groundwater Model, Section 2.5.1). The RIR Section 5.0 figures depicting the extent of groundwater plumes were conservatively estimated from point measurements of constituent concentrations in groundwater and in pipeline water (RIR, Section 5.1.2). The plumes depicted in the Section 5.0 figures give a conservative estimate of the extent of groundwater contamination but do not indicate the directional flow of groundwater.

Number	Comments	Response
271	(NYSDEC) Page 5-22, Section 5.3.1.4, 1st bullet: It is not so much the concentration of cesium-137 in groundwater samples, but more its presence that is of concern	The high concentrations of cesium-137 in groundwater noted by this comment are from total phase (unfiltered) samples that had high levels of suspended solids or turbidity (RIR, Section 5.3.1.4). Nearly all corresponding dissolved fraction (filtered) samples showed non-detections or minor detections of cesium-137. Since cesium-137 appears to be in a non-dissolved state, transport through groundwater is likely to be limited.
272	(NYSDEC) Page 5-22, Section 5.3.1.4. 2nd bullet: The concentration of tetrachloroethene in monitoring well 415A warrants additional investigation and possible interim remedial actions. Please note that due to the low solubility of tetrachloroethene, the high concentration of tetrachloroethene detected in well 415A may indicate the presence of separate phase product in the vicinity of this location. The Department will not consider natural attenuation as a viable remedial option to address contamination of this magnitude.	Additional investigation of volatile organic compound contamination in Exposure Unit 4 groundwater was conducted in late 2009 and the results will be presented in the RIR Addendum (Section 4.3). This investigation began with an examination of existing boring logs to locate potential sand lenses including borings/wells completed on CWM property. Soil samples from boring 415 indicate an increasing volatile organic compound concentration with depth. These and other local data were used to better define the contamination via temporary well points that will lead to optimally placed permanent wells for remedy development. Monitoring well installations were positioned for optimal compliance, "plume" bounding, and long-term monitoring.
273	(NYSDEC) Page 5-23, Section 5.3.1.5. 1st bullet: Just because a contaminant is not prevalent at numerous locations does not exclude the possibility of it being a problem at individual locations.	The Corps agrees with this statement; however, this is a discussion of the occurrence and distribution of site-related constituents (RIR Section 5.3.1.5). Data for all positively detected analytes was used for the determination of site-related constituents and for evaluation of potential risks. Due to the large number of samples taken at NFSS and the number of constituents analyzed for, it was not feasible to evaluate every individual sample location. Evaluation on an exposure unit basis was necessary for purposes of the Baseline Risk Assessment but final remedial actions will take all data points into consideration.

Number	Comments	Response
274	(NYSDEC) Page 5-24, Section 5.3.1.5, 5th bullet: The results of samples collected from MH32 and MH35 are not discussed in the groundwater section of this exposure unit. The results are discussed further in Section 5.3.2.	Although these samples were not individually discussed in the groundwater section (Section 5.3.1.4), they were called out in the media interactions section (Section 5.3.2) due to the interaction between the groundwater plumes shown on Figures 5-8 through 5-12 and the pipeline system in Exposure Unit 4.
275	(NYSDEC) Page 5-24, Section 5.3.1.5, Sanitary Sewers, 1st bullet: The concern, again, is the presence of cesium-137 in samples, not necessarily the concentration. Is there a theory on whether these cesium-137 detections are due to groundwater infiltration or the opposite?	A site-wide evaluation of fission products, including cesium-137, is presented in Section 5.9.4.3. Although the predominant radionuclides of potential concern at the NFSS include the naturally occurring uranium, thorium and actinium decay series, fission products like, cesium-137, associated with past waste storage activities, are also present at low concentrations. It should be noted that cesium-137 exists at low levels across NFSS and around the world as a result of fallout from past atmospheric testing of nuclear weapons and the widespread reporting of cesium-137 in onsite media is, in part, due to the fact that cesium-137 is a natural reporting feature of gamma spectroscopy analysis and apparently a product of turbid water samples. However, the most likely source for cesium-137 at the NFSS is the Knolls Atomic Power Laboratory (KAPL) waste stored at the site from 1952 through 1954. The KAPL wastes contained some residual plutonium and fission product radioactivity, such as cesium-137, from a low-level radioactive processing plant at the KAPL facility in Schenectady, New York. In addition to the KAPL materials, electron tubes (gaps) containing cesium-137 that were stored and/or disposed of at the NFSS and LOOW could also have contributed to the cesium-137 contamination. The NFSS Baseline Risk Assessment identified cesium-137 as a radionuclide of concern in soil and groundwater so cesium-137 will be addressed by the FS.

Number	Comments	Response
276	(NYSDEC) Page 5-25, Section 5.3.1.5. Storm Sewers, 1st bullet: It is interesting to note that adjacent manholes MH35 (acid sewer) and MH22 (storm sewer) both detected VOCs. However an investigation of groundwater in the vicinity was not conducted to determine if this media is affected. Investigation of this area should be conducted.	Manholes MH22 and MH35 are located in the north central portion of Exposure Unit 4 (RIR, Figure 3-8). MH22 is located on a storm sewer but, because it was dry at the time of sampling, only manhole sediment was sampled. MH35 is located on an acid sewer line and manhole water collected at this location contained low levels of volatile organic compounds. Considering the fact that MH22 and MH35 are on separate lines, that MH22 was dry, and MH35 contained only low levels of volatile organic compounds, no further groundwater investigation is warranted in this area. However, Section 5.3.2 of the RIR states that there likely is an interaction between the volatile organic compounds groundwater plumes shown on Figures 5-8 through 5-12 and the pipeline system in Exposure Unit 4. Additional soil and groundwater sampling in Exposure Unit 4 was conducted in late 2009 as part of the RIR Addendum activities. The results of this investigation will be presented in the RIR Addendum (Section 4.3).
277	(NYSDEC) Page 5-25, Section 5.3.2: How can the limit of contamination in the pipeline be determined when no samples are collected downstream of the impacted locations? Additional sampling is necessary.	Additional soil, soil gas, and groundwater sampling was conducted in late 2009 to investigation volatile organic compound contamination in Exposure Unit 4. The results of this investigation will be presented in the RIR Addendum (Section 4.3).

Number	Comments	Response
278	(NYSDEC) Page 5-26, Section 5.3.3, 2nd bullet: Please note the following with respect to past usage of tetrachloroethene: Multiple government uses of the property involved the use of solvents such as the Navy Interim Pilot Production Plant, Air Force Plant 68, and the Boron-10 Plant. Evidence of past disposal in the area includes abandoned drums, waste piles, pipes, sumps. It is not unreasonable to consider past government operations as a potential source. Please remove the last sentence of this bullet, since the contamination noted on the NFSS is not associated with CWM operations, although CWM does operate groundwater extraction systems associated with past Federal Government contamination (P1202s and PCB Warehouse remedial systems).	The 2nd bullet on page 5-26 acknowledges that, although the source of the volatile organic compounds was not established, their presence may be due to past storage activities of the military and the Atomic Energy Commission. Additional soil and groundwater sampling was conducted in late 2009 to investigation volatile organic compound contamination in Exposure Unit 4. The results of this investigation will be presented in the RIR Addendum (Section 4.3).
279	(NYSDEC) Page 5-26, Section 5.3.3, 5th bullet: The presence of bis(2-ethylhexyl)phthalate in sample results could also be associated with analytical laboratory contamination.	All bis(2-ethylhexyl)phthalate detections in groundwater were addressed during data validation and were handled in accordance with EPA's National Functional Guidelines for Superfund Organics Methods Review (EPA 2008). Since phthalates are acknowledged as common laboratory contaminants, the results for bis(2-ethylhexyl)phthalate in groundwater were considered positive results only if the concentrations in the sample exceeded ten times the amount detected in the associated blanks.
280	(NYSDEC) Page 5-26, Section 5.3.3, 6th bullet: The presence of PCBs in this area could be related to oil jacketed lines, heat transfer fluids or gaskets caulks and seals. The presence of PCE could be associated with the disposal of spent solvent associated with the operations discussed in the comments in the 2nd bullet.	Noted. The RI serves as a mechanism for collecting data to characterize site conditions; determine the nature and extent of contamination; assess risk to human health and the environment; and to collect data necessary to evaluate potential treatment options. (RIR, Section 1.3) Unless there was specific historical documentation of the various sources, speculation regarding the source of documented contamination was not included in the RIR.

Number	Comments	Response
281	(NYSDEC) Page 5-26, Section 5.3.3 8th bullet: It is expected that elevated gamma walkover survey readings would be associated with surface soil containing radionuclides.	Concur. The bullet states that there appears to be a correlation between elevated readings detected during the gamma walkover and soil samples collected during Phase 3 RI soil sampling for radionuclides.
282	(NYSDEC) Page 5-27, Section 5.4.1: It would have been helpful if subsurface samples were taken northeast of road core RC 14 to assist in bounding the groundwater/soil contamination noted on the CWM side of the fence.	There is no groundwater plume in Exposure Unit 6 and groundwater flow is generally to the northwest. Therefore, collecting subsurface soil samples in the area northeast of RC14 does not seem necessary. A data summary for all railroad ballast and building and road core samples is provided in Table 4.2 of the RIR. The RIR Addendum will include a comparison of these samples to surface soil background levels and risk-based limits appropriate for soil exposures.
283	(NYSDEC) Page 5-32, Section 5.4.1.4, 2nd paragraph: Data from monitoring well BH57 (screened in the upper Queenston formation) should not be compared to background values for the lower water-bearing zone data.	Since monitoring well BH57 is screened in the unweathered portion of the Queenston Formation at a depth interval of 91.5 to 101.5 feet while the deepest background well is screened at a depth interval of 41.4 to 44.8 feet, there is a possibility that the background data set may not be representative of groundwater samples collected at well BH57. This may explain why concentrations of dissolved radiological parameters exceed the upper tolerance limits of background at this well (i.e., long residence time of the groundwater in the rock allows naturally occurring radiological materials to be dissolved in groundwater). However, to increase the statistical power of the background determination and to establish one site-specific background value for groundwater, all upper water-bearing zone and lower water-bearing zone groundwater samples were combined to form the background groundwater data set. For both water-bearing units, wells were selected to provide a good spatial representation of the area covered by the right-of-entry.
284	(NYSDEC) Page 5-33, Section 5.4.2: When discussing elevated surface soils in the southeast corner of Exposure Unit 6, is the author referring to sample locations 606 and/or 6B005?	Refer to Figures 4-7a and 4-7b to see the Exposure Unit 6 sample locations with elevated radionuclide detections. Sample locations with elevated radionuclide detections in the southeast corner of Exposure Unit 6 include 606, 6C005, 829, EU061, 6C003, 6C006, and 6B005.

Number	Comments	Response
285	(NYSDEC) Page 5-35, Section 5.5.1.1: Please provide the locations, detected parameters and concentrations of contaminants discussed in this section. The current discussion is vague.	Figures 4-9a and 4-9b and Tables 4-17, 4-23, 4-42 and 4-57 summarize the occurrence of site-related constituents in soil at Exposure Unit 8. Conclusions and findings are summarized in Section 5.5.1.1. The level of detail provided in this summary is the same as that provided for the other exposure units.
286	(NYSDEC) Page 5-36, Section 5.5.1.1, 1st and 2nd bullet: Please note that the source of debris piles investigated by trench 302 and 305 is believed to be the result of Department of Energy remedial work preformed on Modern Landfill property in the 1980's (Vine Street/Vicinity Property N North).	Noted. The RI serves as a mechanism for collecting data to characterize site conditions; determine the nature and extent of contamination; assess risk to human health and the environment; and to collect data necessary to evaluate potential treatment options. Unless there was specific historical documentation of the various sources, speculation regarding the source of documented contamination was not included in the RIR.
287	(NYSDEC) Page 5-38, Section 5.5.1.4, 1st bullet: Please note that the groundwater contamination noted in samples collected from wells 302/302A and 313 are not part of a "plume" and have different radiological signatures.	The Exposure Unit 8 dissolved phase uranium plume shown on Figures 5-1 through 5-4 was delineated using relatively few data points including data collected from MW302, MW302A and MW313. This method for groundwater plume delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated. It is not clear how the “radiological signature” at these wells is different or what it is different from.

Number	Comments	Response
288	(NYSDEC) Page 5-40, Section 5.5.2: The best explanation of the dissolved uranium plume is that the "plume" does not exist and is a figment of computer contouring.	Although the configuration of contamination in groundwater at the NFSS may be irregular rather than uniform, as depicted by a classic uniform plume, contaminated groundwater areas at the NFSS were referred to as "plumes" in the RIR for the purpose of evaluating constituents present in groundwater (RIR, Section 5.1.2). The extent of contamination was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. In many cases, extent of contamination was defined by only two or three data points. This method for groundwater contaminant delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated.
289	(NYSDEC) Page 5-43, Section 5.6.1.1, 2nd bullet: Subsurface soil sample 8D006 (0.8) should also be noted when discussing samples with elevated contaminants.	Noted. All samples with elevated contaminants were not included in the discussion, however, all Exposure Unit 7 sampling locations with site-related constituents are presented graphically in Figure 4-8a.
290	(NYSDEC) Page 5-45, Section 5.6.1.1, 4th bullet: Was a sample of the "chips" exhibiting the high gamma readings collected and analyzed?	Trench 808 was excavated in Exposure Unit 7 to investigate the organic burial area. Chips of material with high gamma readings found in Trench 808 were not collected or analyzed because radiological contamination was not the focus of investigations in this area.
291	(NYSDEC) Page 5-46, Section 5.6.1.1, 1st bullet: The detection of "Niobium-95" in Trench 810 should be discussed.	Based on discussion with the laboratory and an earlier request from Maxim, the initial detect for niobium-95 was re-evaluated by analysts at General Engineering Labs in 2004. In this re-assessment report the results for niobium-95 were revised to indicate a non-detect result for this particular radionuclide. Results for this sample’s duplicate sample also showed non-detectable results for niobium-95. The niobium-95 result from the Trench 810 sample was flagged with the data qualifier “R” indicating that the data is unusable and the “OK_TO_USE” notation was later changed to “False” in the database.

Number	Comments	Response
292	(NYSDEC) Page 5-49, Section 5.6.1.4, 2nd bullet: Additional investigation is required to support the statements in this bullet. The elevated uranium-234 samples were collected from different media (groundwater and sanitary sewer). Other groundwater samples in the vicinity do not indicate contamination of the same magnitude and characteristics.	The uranium groundwater plumes located south of the IWCS are believed to be associated with activities conducted at former Building 409. Since the RIR was released, new information regarding the shape and extent of the groundwater plume in the vicinity of the former Building 409 (which is explained further below) has been reviewed and this information suggests that the configuration of this plume may over estimate actual groundwater contamination. The Building 409 plume shown in the RIR was drawn using dissolved total uranium data from monitoring wells, temporary well points and manhole locations. The linear plume extending north and east was drawn using uranium concentrations from one temporary well point (TWP833) and an existing manhole (MH06) on a sanitary pipeline. The plume was drawn assuming that groundwater was following a 10-inch potable water line which was left in place. For plume delineation, water in the manhole was assumed to be in direct contact with groundwater. In researching this plume, it was found that the concentration of dissolved total uranium at the temporary well point (TWP833) in the center of this plume had been misreported by the laboratory. The actual concentration was ten times lower than what was reported in the RIR. Also, the configuration of the plume is conservative because it was drawn assuming that pipeline water was in direct contact with groundwater, which does not appear to be the case. If we correct the misreported uranium value at the temporary well point, remove manhole data since it is not representative of groundwater, only include data measured in groundwater and include more recent data collected in this area for the RIR Addendum, the configuration of the plume is different. The RIR Addendum will present a revised uranium groundwater plume map based on this updated information. The results of this investigation will be reported in the RIR Addendum, Section 4.5.

Number	Comments	Response
293	(NYSDEC) Page 5-49. Section 5.6.1.4, 4th bullet: The concern with cesium-137 is not the concentration but rather its presence since cesium is not associated with uranium milling residues.	Although the predominant radionuclides of potential concern at NFSS include the naturally occurring uranium, thorium and actinium decay series, fission products associated with past waste storage activities are also present at low concentrations. It should be noted that cesium-137 exists at low levels across NFSS and around the world as a result of fallout from past atmospheric testing of nuclear weapons. However, the most likely source for cesium-137 at the NFSS is the Knolls Atomic Power Laboratory (KAPL) waste stored at the site from 1952 through 1954. Supplemental records on nature and handling of KAPL materials will be presented in the RIR Addendum, Section 12.1. The KAPL wastes contained some residual plutonium and fission product radioactivity, such as cesium-137, from a low-level radioactive processing plant at the KAPL facility in Schenectady, New York. It is estimated that 408 curies of mixed fission products and 0.63 curies of plutonium were shipped to the NFSS during this time period. However, a majority of the KAPL waste was either burned on-site or shipped to Oak Ridge Reservation for disposal. In addition to the KAPL materials, electron tubes (gaps) containing cesium-137 and strontium-90 that were stored and/or disposed of at the NFSS and LOOW could also have contributed to the cesium-137 contamination. Another possible source of cesium-137 at the NFSS is radioactive wastes from the University at Rochester that were buried on Vicinity Property G but were later excavated and removed. Cesium-137 was identified as a radionuclide of concern in several media at several exposure units and, as such, will be assessed further during the FS.
294	(NYSDEC) Page 5-49, Section 5.6.1.4, 5th bullet: Bis(2-ethylhexyl)phthalate is a common laboratory contaminant. The concentrations noted are not unusual in analytical reporting.	All bis(2-etylhexyl)phthalate detects were addressed during the data validation. The samples remaining after the validation had no bis(2-ethylhexyl)phthalate in the associated laboratory blanks and were therefore retained as positive detections in the database.

Number	Comments	Response
295	(NYSDEC) Page 5-49, Section 5.6.1.5: Due to the detection of elevated contaminants in samples collected from the underground utilities and the potential of these pipelines to serve as a migration pathway, further field investigation is required.	Between August and October of 2006, the Corps collected a total of 60 samples for radiological analysis from within or adjacent to underground utility lines on the former LOOW site including the 30-inch outfall to the Niagara River. Samples were analyzed for radiological constituents including, but not limited to, isotopic uranium, isotopic thorium, radium-226, and radium-228. The results of this sampling were reported in a FUSRAP Fact Sheet available online at http://www.lrb.usace.army.mil/derpfuds/loow-nfss/loow-fs-radundgutil-2007-10.pdf. The Remedial Investigation of Underground Utilities completed for the LOOW found that the deepest and most heavily chemically contaminated pipelines were the acid waste and sanitary sewer lines as they approach the wastewater treatment plant north of the NFSS (EA Engineering, Science, and Technology, Inc. [ES&T] 2008). One sanitary line and two acid waste lines extend off the NFSS to the north. All of these lines were sealed at the property boundary and the Remedial Investigation of Underground Utilities indicates that no bedding material, which could act as a preferential pathway for contaminant migration, was present around the pipelines leaving the NFSS (EA ES&T, November 2008). A fact sheet that discusses the results of this investigation can be found at: http://www.lrb.usace.army.mil/derpfuds/loow/loow-fs-uuri-2009-05.pdf. Additional information regarding a radiological investigation of underground utilities leaving the NFSS will be presented in Section 10.0 of the RIR Addendum.
296	(NYSDEC) Page 5-51, Section 5.6.2: The localized areas of groundwater contamination identified north of the IWCS could be related to the open storage of R-10 residues in vicinity of this area.	This is acknowledged in Section 5.6.3 which explains that prior to construction of the IWCS, the R-10 pile was located on the ground north of the LOOW freshwater treatment plant where it was left unprotected for several years. The comparison of historical site operations near the IWCS, including the R-10 pile, with current groundwater contamination will be presented in the RIR Addendum, Section5.4.

Number	Comments	Response
297	(NYSDEC) Page 5-51, Section 5.6.3, 1st bullet: The disposal of building materials in the burial areas could be a potential source of detected contaminants.	Noted. This is acknowledged by the 1st bullet in Section 5.6.3.
298	(NYSDEC) Page 5-51. Section 5.6.3, 2nd bullet: It is highly unlikely that cesium-137 would migrate up-gradient in groundwater from Exposure Units 1 & 2 to Exposure Unit 7.	The 2nd bullet in Section 5.6.3 does not suggested that cesium-137 would have migrated via groundwater from Exposure Units 1 and 2 to Exposure Unit 7; rather, that the KAPL waste stored in these areas is assumed to be the source of the cesium-137 contamination. Although historic documents provide some information about where KAPL wastes were stored on-site, it is not known with certainty if the materials remained solely in those identified locations or if they were transported around the site. Therefore, it is possible that any cesium-137 contamination on site may have resulted from KAPL wastes that were known to have been stored in Exposure Units 1 and 2.
299	(NYSDEC) Page 5-52, Section 5.6.3, 3rd bullet: Soil samples should be collected from the areas on the northwest, east and southeast side of the IWCS where elevated gamma readings were noted, to address this identified data gap.	RIR Addendum activities included additional soil and groundwater sampling conducted in late 2009. This sampling will focus on select areas of the site where plume delineation is needed or where there is a potential for off-site migration of contaminants via groundwater. These areas of interest included the area south and west of the IWCS. The results of this investigation will be included in the RIR Addendum, Section 4.5. Soils surrounding the IWCS will be addressed as part of the Balance of Plant operable unit during the FS.

Number	Comments	Response
300	(NYSDEC) Page 5-53, Section 5.7.1.1: In summary, the contaminated soil identified in the vicinity of Building 401 will need to be addressed as part of the removal and remediation of Building 401.	The demolition of Building 401 will be performed using $6.5 million in funds received through the American Recovery and Reinvestment Act. The scope of work for this project has been posted on the web at: http://www.lrb.usace.army.mil/fusrap/nfss/nfss-bldg401-nepascoping-2009-09.pdf. The services required under this Scope of Work involve characterization, and packaging of miscellaneous debris in Building 401 at NFSS, demolition of Building 401, and segregating, packaging, loading, transporting, and disposing of the demolition debris and other packaged wastes at appropriately permitted or licensed disposal facilities. The Corps plans to award the contract for this Scope of Work and begin demolition in 2010. The demolition, transportation, and disposal work is scheduled to be complete in 2011.
301	(NYSDEC) Page 5-59. Section 5.7.1.4, 3rd bullet: The text of this bullet points out why the areas of elevated concentrations in groundwater should not be referred to as plumes at this facility.	Although the configuration of contamination in groundwater at the NFSS may be irregular rather than uniform, as depicted by a classic uniform plume, contaminated groundwater areas at the NFSS were referred to as "plumes" in the RIR for the purpose of evaluating constituents present in groundwater (RIR, Section 5.1.2). The extent of contamination was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. In many cases, extent of contamination was defined by only two or three data points. This method for groundwater contaminant delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated.

Number	Comments	Response
302	(NYSDEC) Page 5-60, Section 5.7.1.5, Floor Drains: The analytical data associated with samples collected from the Building 401 floor drains identified high levels of various contaminants. These drains (and associated piping) must be addressed as part of the building remediation and removal.	The demolition of Building 401 will be performed using $6.5 million in funds received through the American Recovery and Reinvestment Act. The scope of work for this project has been posted on the web at: http://www.lrb.usace.army.mil/fusrap/nfss/nfss-bldg401-nepascoping-2009-09.pdf. This project entails environmentally sensitive deconstruction of Building 401 allowing access for further remediation of potentially contaminated features such as sumps and drains. The scope of work specifies that all sumps and drains be emptied then plugged to prevent decontamination agents or contaminated debris from entering the drains. The Corps plans to award the contract for this Scope of Work and begin demolition in 2010. The demolition, transportation, and disposal work is scheduled to be complete in 2011.
303	(NYSDEC) Page 5-62, Section 5.7.3, 2nd bullet: It would be useful if, as part of the discussion on the correlation of soil sample results to gamma walkover data, there was an evaluation of the soil data to determine if other radioactive parameters were present besides gamma emitters. In other words, was the gamma survey effective in identifying areas of surface radiation contamination, given the range of radioactive materials possibly present?	Gamma walkover surveys are particularly sensitive to gamma emitters (e.g. cesium, thorium and radium). Sample results for these constituents correlated well with gamma walkover results. However, it was understood that some constituents of concern would not be detected by the gamma walkover. Therefore, soil samples acquired at gamma "hot spots", as well as samples taken in areas without gamma walkover responses, were analyzed for alpha emitters, metals and organics as well. These results are discussed on an exposure unit basis throughout the RIR.

Number	Comments	Response
304	(NYSDEC) Page 5-74, Section 5.10.1.4, 1st bullet: Please rewrite to read: "Several areas of localized groundwater contamination were identified...". The term "plume" gives the impression of migration. Also, see previous discussion on areas of groundwater contamination.	It is acknowledged that, given the irregular configuration of areas of groundwater contamination at the NFSS, use of the term "plume" to describe these areas may overstate impacts to groundwater (RIR, Section 5.1.2). The extent of contamination was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. In many cases, extent of contamination was defined by only two or three data points. This method for groundwater contaminant delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated.
305	(NYSDEC) Page 5-75, Section 5.10.1.4, 2nd bullet: Given its proximity to the IWCS and concerns over the identified contamination in the former Building 409 area, additional characterization and remedial work are warranted.	The RIR Addendum will present a revised uranium groundwater plume map for the Building 409 vicinity based on updated information (Section 4.5). Additional investigation of soil and groundwater was conducted south of the IWCS in late 2009. Results from this supplemental investigation also will be reported in the RIR Addendum.
306	(NYSDEC) Page 5-75, Section 5.10.1.4, 3rd bullet: Figure 5-16 does not accurately portray the groundwater potentiometric surface of the upper water-bearing zone at the NFSS.	The potentiometric surface depicted in Figure 5-16 was derived from field-measured site data. The resulting potentiometric surface reveals that groundwater flow in the upper water-bearing zone does not follow a smooth and continuous pattern, but is highly irregular. Localized variations in flow direction are attributed to the low permeability of the upper water-bearing zone materials and the presence of intermittent sand lenses. The temporal lag of head in wells from the till matrix versus sand lenses produce this irregular potentiometric surface, which requires some interpretive inferences. On a regional scale, groundwater flow patterns are expected to be to the north-northwest as shown by the regional flow patterns published by the United States Geologic Survey as shown in Figure 2.29 of the modeling report (Groundwater Model, Section 2.5.1).

Number	Comments	Response
307	(NYSDEC) Page 5-76, Section 5.10.1.4, 2nd bullet: This statement is not adequately supported by information gathered as part of the RI. Additional groundwater monitoring investigation is required to substantiate.	The bullet states that there is a potential that the dissolved total uranium plume extends offsite north of Exposure Unit 1. This possibility was explored further during the RIR Addendum investigation completed late in 2009. To define the extent of the uranium plume, soil and groundwater sampling will be conducted on- and off-site around the northwest boundary of the NFSS where a uranium plume may cross the site boundary onto the Town of Lewiston property (former LOOW wastewater treatment plant). The results will be included in the RIR Addendum, Sections 3.4.3 and 4.2). Based upon the findings of this investigation, additional enhancements to the Environmental Surveillance Program may occur to account for the possibility of off-site contaminant migration via groundwater.
308	(NYSDEC) Page 5-78, Section 5.10.2: Replace "plumes" with "groundwater impacts".	It is acknowledged that, given the irregular configuration of areas of groundwater contamination at the NFSS, use of the term “plume” to describe these areas may overstate impacts to groundwater (RIR, Section 5.1.2). This method for groundwater contaminant delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated.
309	(NYSDEC) Page 6-1, Section 6. 1, 2nd paragraph: New York state regulations must also be considered ARARs.	The FS will consider all potential Applicable or Relevant and Appropriate Regulations (ARARs) including federal and state policies, guidelines, or rules developed to address potential risks like those documented for the NFSS.
310	(NYSDEC) Page 6-3, Section 6.1, Semi-volatile organic compounds: Bis(2-ethylhexyl)phthalate is a common laboratory contaminant. Evaluation of analytical data detecting this compound should take that into consideration.	All bis(2-ethylhexyl)phthalate detections were addressed during data validation. Its status as a common laboratory contaminant was not overlooked. Samples remaining after the validation showed no bis(2-ethylhexyl)phthalate in the associated laboratory blanks and were therefore retained as detects in the database.

Number	Comments	Response
311	(NYSDEC) Page 6-8, Section 6.6: Please see Department comments on the "Groundwater Flow and Contaminant Transport Modeling Report".	NYSDEC comments on the Groundwater Flow and Contaminant Transport Modeling Report (USACE 2007c) include comments 198-212.
312	(NYSDEC) Page 6-9, Section 6.6.1, Item "3": Please see previous comments on the depiction of groundwater contamination.	It is acknowledged that, given the irregular configuration of areas of groundwater contamination at the NFSS, use of the term "plume" to describe these areas may overstate impacts to groundwater. However, this method for groundwater contaminant delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination (RIR, Section 5.1.2). This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated.
313	(NYSDEC) Page 6-9, Section 6.6.1, last paragraph: As previously commented on in Section 5, the "definition" of a groundwater plume is not based on actual field/geologic conditions. Given the groundwater flow characteristics of the upper water bearing unit, and attenuation of contaminants in geologic material with a high ion exchange potential, the release would have to have occurred approximately 1000 years ago in order for contaminants to have migrated the distance depicted by the report in the northwest portion of the NFSS.	The extent of groundwater contamination at the NFSS was estimated from point measurements of constituent concentrations in groundwater and in pipeline water (RIR, Section 5.1.2). In many cases, the extent of contamination was defined by only two or three data points. However, groundwater impacts may reflect more widespread storage methods for radiologically contaminated materials at the site. Remedial measures of the early to mid 1980s removed radiologically-contaminated sources but left less impacted soils that cannot be directly tied to existing plumes (i.e., impacted soil footprints are different and residual soil contamination is too low to generate the groundwater impacts seen). Consequently, the plumes appear larger and more concentrated than what the current conditions would have generated.

Number	Comments	Response
314	(NYSDEC) Page 6-10, Section 6.6.2: Please understand that modeling is a tool used as part of the remedial decision making process. Results of modeling are only as good as the imputed data and assumptions used. The drawbacks of modeling for the time frames evaluated here are inherent with the inability to calibrate and validate for the long period (1000`s of years).	Agreed. Conservative assumptions were used in the model development where possible. This approach serves to account for some of the uncertainty in the long term simulations. To further address uncertainties, worst-case scenario simulations were performed to provide insight into how the model may respond to impacts that currently have a low statistical probability of occurring, but could hypothetically occur over a long-time period (Groundwater Model, 4.5.2). It is recognized that the modeling is only one tool that will be used to guide the development, evaluation, and ultimate selection of a remedy at the NFSS.
315	(NYSDEC) Page 6-13, Section 6.6.4: While the distribution coefficient (K_d) used for uranium-238 (3.6 L/Kg), as part of the groundwater modeling, is much lower than what would be expected in a clay rich material; the purpose of the modeling was to present a worst case scenario.	It is recognized that there is uncertainty in the model predictions. This uncertainty was addressed through the assignment of conservative transport parameters such as the distribution coefficient used for uranium, completion of a sensitivity analysis, and the simulation of several worse-case predictive scenarios. This information will be considered when developing and evaluating remedial options during the FS.
316	(NYSDEC) Page 7-4, Section 7.2.2, 2nd paragraph: Please change strontium-190 to strontium-90.	This typographical error is noted, however, correction of this error will not change the conclusions of the RIR.

Number	Comments	Response
317	(NYSDEC) Page 7-9, Section 7.3.2. Recommendations: Please clarify the proposed recommendations for Subsurface Utilities (How did the contaminants detected in this media drop out?)	No further action was recommended for exposure to the contents of subsurface utilities in Exposure Unit 2. The Baseline Risk Assessment concluded that contaminants in the pipelines did not pose unacceptable risk for the short-term exposures assumed for construction workers exposed to this media (BRA, Section 5.4.16). However, it is acknowledged that contamination exists in this media, and it will be further evaluated in the FS and also for potential off-site migration concerns. In Exposure Unit 2, uranium isotopes were detected above the background levels in sediment in a sanitary sewer line southwest of the intersection of O Street and Campbell Street. Cesium-137 was detected above the background level in sediment in a storm sewer line near Campbell Street. Radium-226 was detected above the background level in surface water from one manhole location. The presence of site-related constituents in all subsurface utilities and pipelines will be further evaluated in the FS as part of the Balance of Plant operable unit.
318	(NYSDEC) Page 7-13, Section 7.3.4, Nature of Occurrence: Given the numerous contaminants and media affected at this exposure unit, additional investigation is necessary to fully characterize the unit. Further investigation must define the nature, extent and rate of migration of the identified contaminants.	The RIR recommends further investigation of Exposure Unit 4 (Acid Area and Vicinity). Additional soil, soil gas and groundwater samples were collected from Exposure Unit 4 during RIR Addendum field work conducted in late 2009. Sampling focused on the delineation of organic solvent plumes and the potential for off-site migration of contaminants via groundwater. Results of this sampling will be presented in an RIR Addendum (Sections 3.0 and 4.0).
319	(NYSDEC) Page 7-15, Section 7.3.4. Recommendations: Remedial action will be required for this exposure unit.	The presence of chemicals of concern and radionuclides of concern in environmental media at Exposure Unit 4 will be further evaluated during the FS.

Number	Comments	Response
320	(NYSDEC) Page 7-30, Section 7.3.10, Recommendations: Besides the IWCS, the FS should evaluate soil/groundwater adjacent to the unit and the ability to monitor the IWCS.	Concur. For the development of the FS remedial action alternatives, soil within, under, and around the IWCS will be considered as part of the IWCS operable unit. Contaminated media outside the IWCS operable unit (e.g. soil, building materials, sediment, and pipelines) will be evaluated as part of the Balance of Plant operable unit. If needed, groundwater will be addressed as a discrete operable unit following the completion of remedial activities for the Balance of Plant operable unit.
321	(NYSDEC) Page 7-38, Section 7.3.13, Recommendations: Building 401 should be taken down, followed by remediation of its foundation and subsurface.	The demolition of Building 401 will be performed using $6.5 million in funds received through the American Recovery and Reinvestment Act. The scope of work for this project has been posted on the web at: http://www.lrb.usace.army.mil/fusrap/nfss/nfss-bldg401-nepascoping-2009-09.pdf. This project entails environmentally sensitive deconstruction of Building 401 allowing access for further remediation of potentially contaminated features such as the foundation slab, sumps and drains. The USACE Buffalo District plans to award the contract for this Scope of Work and begin demolition in 2010. The demolition, transportation, and disposal work is scheduled to be complete in 2011.

Number	Comments	Response
322	(NYSDEC) Page 7-42, Section 7.3.15, Recommendations: Site drainage should continue to be monitored with respect to remedial actions taken at other exposure units and to assess groundwater discharge to surface water.	The Environmental Surveillance Program will continue to monitor on-site surface water and sediment. Since the Environmental Surveillance Program monitoring began on the NFSS in 1981, its purpose has evolved to include demonstration of continued containment of wastes and residues buried within the IWCS and to ensure that on-site contamination does not pose a threat to human health and the environment. This monitoring will continue until all remedial activities for the site are complete. To address the uncertainty associated with the uranium plume west of the IWCS, three new surface water and sediment locations in the West Drainage Ditch (Exposure Unit 9) were added to the Environmental Surveillance Program sampling conducted in October 2008. Surface water and sediment results from this sampling event will be reported in the RIR Addendum and will be used to determine the need for monitoring wells in Exposure Unit 9 (RIR Addendum, Sections 4.5 and 9.0).

Number	Comments	Response
323	(NYSDEC) Page 7-46, Section 7.3.17, Recommendations: As stated previously, the characterization of groundwater contamination in this report is not accurate or scientifically based. Any conclusions based on the flawed assumptions are also potentially flawed.	Although the configuration of contamination in groundwater at the NFSS may be irregular rather than uniform, as depicted by a classic uniform plume, contaminated groundwater areas at the NFSS were referred to as "plumes" in the RIR for the purpose of evaluating constituents present in groundwater (RIR, Sections 5.1.1 and 5.1.2) . The extent of contamination was estimated from point measurements of constituent concentrations in groundwater and in pipeline water. In many cases, extent of contamination was defined by only two or three data points. This method for groundwater contaminant delineation was considered appropriate since it conservatively estimates, or overestimates, the actual extent of groundwater contamination. This conservatism was used to account for uncertainty associated with the distribution of data points and to ensure that risks are not underestimated. Additional groundwater sampling was conducted as part of the RIR Addendum field work in 2009 (RIR Addendum, Section 3.0). Results of this sampling and a refinement of the understanding of groundwater contamination in areas of interest at the NFSS will be presented in the RIR Addendum (Section 4.0).

Number	Comments	Response
324	Groundwater Model (HGL 2007). Subsurface Geologic Conditions. It is rare that modelers have such a wealth of subsurface data as is available for the NFSS, CWM and Modern sites. More than 700 boreholes were evaluated to assess the geologic conditions and related data needed for input parameters to the flow and transport models. However, as in all geologic sampling exercise, the information and knowledge gained is derived from discrete locations where the samples were taken. It is often necessary to make assumptions as to what conditions exist between boreholes, and it is important that subsurface data be available to provide a three-dimensional understanding of the geologic lithology, stratigraphy and characteristics. As shown in the report (see HGL Fig 2.8), many borehole locations are available on the NFSS, CWM and to a lesser degree on the Modern Landfill. However, there is a paucity of data to the west and northwest of the NFSS, which also happens to be the general direction of groundwater flow. Therefore, there is uncertainty as to actual conditions in this important region of the model and requires modelers to make assumptions as to continuity of geologic units and their properties. This can be considered to be a data gap in knowledge of subsurface conditions.	The hydrogeologic model that was developed using data from the NFSS, CWM, and Modern Landfill was extended to areas outside the limits of the data. This conceptual understanding was supplemented with limited data that were available outside this area, including a regional potentiometric surface map and the location of known regional groundwater discharge areas (Niagara River and Lake Ontario). The extensive on-site borehole information helps confirm the nature and lateral extent of the depositional units. The glacio-lacustrine clay, for example, is shown to be laterally extensive (westward) validating what its glacio-lacustrine depositional nature would suggest. While it is true that there is a paucity of data to the northwest of the NFSS, this area is not the primary focus of the model. The primary focus of the model was to evaluate the potential for off-site migration from the NFSS. The remaining uncertainties in hydrogeologic conditions northwest of the NFSS are not expected to have a significant impact on the ability of the model to predict whether contaminants will migrate off-site. The wealth of available borehole data reduces uncertainty with respect to the representation of on-site subsurface conditions in the model. Extensive subsurface data also reduces uncertainty in the predictive simulations which suggest that the transport of dissolved contaminants to the northwest is limited to localized exceedances due to plume maps. Thus, given the predicted extent of plume migration, confirmation of the conceptual model to the northwest is not a significance data gap. The comment on the presence of fractures in the upper clay till is based on Section 2.2.2.3.2 of the Groundwater Modeling (USACE 2007c), which provides a description of the lithology of the upper clay till. The Groundwater Model indicates that “Minor cracks and joints have been observed to a depth of approximately 9 ft (2.7 m) below the surface” This characteristic of the upper clay till was based on the Wehran Engineering report for Modern Landfill (Wehran 1979) which HGL reviewed as

Number	Comments	Response
324 (cont.)	The presence of fractures in the upper clay till to a depth of approximately 9 feet (2.7 m) is noted and characterized as minor. However, discontinuities in the clayey matrix due to fracturing is commonly observed in surficial clay tills and their role in contaminant fracture has been found to be significant.	part of its efforts in developing the conceptual model. While the HGL report made note of the presence of discontinuities in the upper clay till, the Wehran report further states that where present, the dessication cracks are filled in with gray clay and silt. The Wehran report bases its findings on observations made within backhoe test pits and the report also states that the frequency of such cracks decreases with depth. By their nature, dessication cracks are characteristically isolated discontinuous features and do not provide an interconnected flow pathway, and the fact that they are filled in further reduces their propensity for contaminant transport. In light of the characteristics and observations of the dessication cracks, they are not considered to be a probable pathway for contaminant migration. As an additional note, the occurrence of such cracks on the NFSS comes into question as the Acres American (1981) report, which provides a fairly detailed description of the lithology on the NFSS, makes no mention of such fractures.

Number	Comments	Response
325	Groundwater Model (HGL 2007). Hydraulic Properties. The evaluation of hydraulic conductivity values provides a reasonable estimation of the characteristics for the various hydrostratigraphic layers. However, it is important to point out that there is variability associated with each layer's properties, and therefore any estimates of groundwater velocity or flux should reflect that variability. For example, it is clear from the distribution of hydraulic conductivity values that the alluvial sand and gravel unit generally has a hydraulic conductivity ten times higher than the upper clay till unit, but the range of values also overlaps. So, there may be areas where the two units have essentially the same hydraulic conductivity. In the big picture, use of geometric mean values is reasonable; however, the variability that may occur at the smaller, local scale should not be overlooked when interpreting groundwater flow and transport. As noted in HGL Table 2.4, the hydraulic conductivity for upper clay till and glacio-lacustrine clay have equivalent geometric means and same values were used in the model (HGL Table 2.5). But, the variability of hydraulic conductivity in the upper clay till extends over six orders of magnitude. The glacio-lacustrine clay is believed to be more homogeneous than the upper clay till, but there are apparently only five hydraulic conductivity measurements. Since the glacio-lacustrine clay is part of the	Hydraulic properties used in the Groundwater Model are discussed in Section 2.3 of the report. Additional information is provided in this comment response. The comment touched on multiple items related to hydraulic conductivity. A response to each item is provided below under the respective headings. Responses were integrated with previous responses where appropriate: (i) <u>Overlapping Ranges of hydraulic conductivity values for different units</u> The objective of the model is to predict long-term contaminant transport. This objective is best met adhering to the scientific-basis that the bulk-averaged properties of the porous media rather than small scale features govern long-term solute movement. Small-scale, disconnected features, while inherent in geologic media, influence solute migration over small spatial and temporal scales. It is recognized that small-scale heterogeneities may influence contaminant transport over short distances; there is no evidence that there are large-scale interconnected features at the NFSS that would lead to preferential contaminant transport over large distances. (ii) <u>Lack of hydraulic conductivity data for the glacio-lacustrine clay</u> Given the low permeability associated with the glacio-lacustrine clay, few wells have been screened in this unit. Consequently, there is a paucity of available hydraulic conductivity data for the glacio-lacustrine clay. However, the reported hydraulic conductivity measurements for the glacio-lacustrine clay are consistent. Finally, although there is a lack of hydraulic conductivity data for the glacio-lacustrine clay, water level data was used to guide calibration of the model and thus provide greater assurance to the values of hydraulic conductivity assigned. (iii) <u>Small-scale features in the glacio-lacustrine clay</u> Refer to response for (i) above. (iv) <u>Lack of hydraulic conductivity data for alluvial sand and gravel</u> Limited hydraulic conductivity data for the alluvial sand and gravel near the IWCS will not materially affect the predictive results of the model within the

Number	Comments	Response
325 (cont.)	underlying natural "containment" of the IWCS, there should be better characterization of the properties of the glacio-lacustrine clay unit. The glacio-lacustrine clay has also been described as containing occasional laminations of silt, and sand and gravel (Golder Associates Inc., 1985; Wehran-Envirotech, 1990; Wehran Engineering Corporation, 1977). These small scale features can be important in transmitting groundwater or contaminants on a local scale. The distribution of hydraulic conductivity for the alluvial sand and gravel unit (HGL Figure 2.23) appears to rely on only three values in the direct vicinity of the IWCS. Since the IWCS is a repository of contaminants, the alluvial sand and gravel is a significant aquifer unit and modeling of the transport form this location is very important, this lack of localized hydraulic conductivity data appears to be a deficiency. Lastly, the distribution of hydraulic conductivity shown on HGL Figures 2.21 to 2.25 are inferred from the available data, and should be regarded as reasonable estimates given the available data. Different values than shown may exist between the borehole locations, and there are no data locations outside of the NFSS, CWM and Modern property lines.	brown clay till. The alluvial sand and gravel underlies the glacio-lacustrine clay and the glacio-lacustrine clay inhibits downward movement of solute into the alluvial sand and gravel. Nevertheless, the available hydraulic conductivity data provides an indication of the variability of the hydraulic conductivity of the alluvial sand and gravel locally. This variability can be used to determine likely upper or lower limits of hydraulic conductivity where there is a lack of measured values, such as near the IWCS. The geometric mean of all alluvial sand and gravel values is 0.05 ft/day and the standard deviation is approximately 1.0 order of magnitude. The calibrated value of alluvial sand and gravel hydraulic conductivity assigned in the model is 0.08 ft/day, which is slightly higher than the geometric mean value, though less than one standard deviation from the geometric mean. (v) <u>Lack of offsite hydraulic conductivity data</u> The hydrogeologic model that was developed using data from the NFSS, CWM, and Modern Landfill was extended to areas outside the limits of the data. This conceptual understanding was supplemented with available limited data from outside this area, including a regional potentiometric surface map and the location of known regional groundwater discharge areas (Niagara River and Lake Ontario). The extensive on-site borehole information helps confirm the nature and lateral extent of the depositional units. The glacio-lacustrine clay, for example, is shown to be laterally extensive (westward) validating what its glacio-lacustrine depositional nature would suggest. While it is true that there is a paucity of data to the northwest of the NFSS, this area is not the primary focus of the model. The primary focus of the model was to evaluate the potential for off-site migration from the NFSS. The remaining uncertainties in hydrogeologic conditions northwest of the NFSS are not expected to have a significant impact on the ability of the model to predict whether contaminants will migrate off-site.

Number	Comments	Response
326	Groundwater Model (HGL 2007). The distribution of sand lenses in the upper clay till is an important feature. The presence of the more-permeable sandy zones within a low-permeability clayey unit holds the implication that there could be pathways or increased migration of groundwater flow and contaminant migration through the sand lenses. Of particular interest, is that for the three waste disposal facilities, the NFSS happens to sit directly over an area which appears to have a higher frequency of sand lens occurrence. The reason as to why more sand lenses were apparently observed in the vicinity of the IWCS may not be known or real, but could be due to the increased density of boreholes on the NFSS, differences in investigation techniques, or just plain bad luck. If a similar density of boreholes were installed in nearby properties, a similar pattern of sand lens occurrence might be observed. The significance of the sand lenses relate to understanding groundwater flow paths, selection of the hydraulic conductivity values used in the model and proper positioning of groundwater monitoring well locations. The authors have evaluated the sand lenses using geostatistics in order to determine the spatial extent of the sand lenses and ultimately whether they are connected flow paths (see Appendix B). The compilation of sand lens data is extensive and thorough. However the semi-variogram approach used is not convincing that the sand lenses are not interconnected.	The sand lens analysis utilized information from 874 boreholes/wells completed on the CWM, Modern Landfill and NFSS properties that extend through the entire thickness of the upper clay till. Approximately 250 of these were on the NFSS property. Sand lenses were encountered in approximately 60% of these boreholes/wells. By comparison, approximately 4% of the 561 boreholes/wells completed on adjacent properties encountered sand lenses. Although more sand lenses were encountered within the NFSS property, they do not appear to be interconnected over significant distances. The geostatistical study concluded that the sand lenses are not interconnected over distances greater than 15 to 20 feet horizontally and over 4 to 5 feet vertically. The geostatistical evaluation of hydrogeological heterogeneity is presented in Appendix B of the groundwater modeling report (USACE 2007c). In the RIR Addendum, the occurrence of sand lenses will be looked at in closer detail to determine if there is a higher density of sand lenses near the IWCS (RIR Addendum, Appendix 12-J). Uncertainties regarding the NFSS subsurface stratigraphy and sand lens connectivity will be further assessed in the RIR Addendum through the preparation of a cross-sectional analysis (RIR Addendum, Appendix 12-J). Cross-section profiles will be developed to verify accuracy and confirm subsurface details in the vicinity of the IWCS and at other locations where impacts to groundwater have been observed.
327	Groundwater Model (HGL 2007). Water Budget. One potential scenario to be considered in the FS is to leave the IWCS residues in place. In that case an assessment of the long term potential climate change issues and effect on precipitation, temperature, evapotranspiration and recharge should be addressed.	The impact of climate change on meteorological conditions in the vicinity of the NFSS is impossible to predict with any accuracy. Nonetheless, the effect of a long-term increase in precipitation would potentially be similar to the worse-case scenarios that were simulated using the model and presented in Section 4.5.2 of the modeling report (USACE 2007c). The results of this scenario likely represent the worse-case impacts associated with dramatic climate change.

Number	Comments	Response
328	Groundwater Model (HGL 2007). Sec 3.3.3.3 The stream boundary for the Central Drainage Ditch is incorrect. The Central Drainage Ditch drains to Four Mile Creek, and not Six-Mile Creek as shown on figures 3.1 and 3.4.	The stream boundaries were assigned based on the locations ascribed in the United States Geologic Survey of eastern Niagara County, New York, 1:25,000 topographic map. This map indicates the Central Drainage Ditch forks with a channel draining eastward into Six Mile Creek and another channel extending toward (though not connecting with) Four Mile Creek. This depiction is also consistent with EPA hydrology maps. Acres American (1981) presents a different flow depiction in which the Central Drainage Ditch flows westward into Four Mile Creek. Acres American (1981) indicates that the Central Drainage Ditch and Six Mile Creek come within a few hundred feet of each other.

Number	Comments	Response
329	Groundwater Model (HGL 2007). Sec 4.3.2.1 The use of distribution coefficient (Kd) isotherm-based sorption models to simulate the migration of metals and radionuclides is a common approach but has strong limitations. The interaction between dissolved ions in solution with solid mineral phases can be described through the use of isotherms. An isotherm is a plot of the mass sorbed on the solid surface versus the concentration of the constituent in solution, at a fixed temperature. As the concentration of the compound sorbed onto a solid surface increased, the mass sorbed also increases in a linear or non-linear manner. Isotherms are empirically derived from laboratory batch or column experiments. The slope of a linear isotherm is known as Kd or the distribution coefficient. The distribution coefficient approach uses one parameter to describe partitioning between solution and solid matrix that may be due to several geochemical processes, and it is usually assumed to be constant in an aquifer. Equilibrium and reversibility of reactions is assumed. Site mineralogy is an important factor, but is neglected (Zhu and Burden, 2001).This simple method of describing ion sorption can be easily incorporated into a mathematical solution of the advection-dispersion equation, that can be solved analytically or by numerical methods. As a result most groundwater solute transport model codes (including the one used for this project) use an isotherm approach to describe surface-solute interaction and retardation formulation. However, the assumptions and difficulties associated with Kds make the applicability of these models to environmental problems concerning metals questionable.	The comment provides a summary of the shortcomings and benefits of the distribution coefficient, or K_d, approach. The comment suggests using a coupled reactive transport model. This approach is not recommend as it requires input of additional data and increased uncertainty with respect to input such as pH, geochemical composition of the sediments, organic matter content and other parameters which may to be highly variable across the site. Moreover, the approach adds additional complexity without reducing uncertainty of the simulation results, particularly at large time scales. The solute transport approach employed accounted for sorption by using a conservative value of K_d, based on NFSS specific data. A conservative value of K_d leads to larger plumes and for the purposes of long-term simulations provides the most conservative assessment of risk. It is noted that MINTEQ equilibrium modeling was performed as part of a geochemical analysis for the purpose of determining appropriate values of solubility for various chemicals of concern. The MINTEQ modeling utilized site specific groundwater chemistry. As the CERCLA process progresses, additional data gaps relative to remedial decision making will be investigated. If highly in-depth groundwater data and analyses are deemed necessary to meet a scientifically defensible remedy, then these data and methods will be investigated. The comment provides a very good reference summary for future use; if full citations are available, please forward.

Number	Comments	Response
329 (cont.)	Deficiencies in the Kd approach have been known for some time (Bethke and Brady, 2000); (Brady and Bethke2000); (Cherry et al., 1984); (Reardon, 1981)), models using Kd are still applied to metals in groundwater problems ((Sandia National Laboratories, 1999); (U. S. EPA, 1996a); (U.S. EPA, 1999); (U.S. EPA, 2001)). Attempts have been made to make the Kd approach more appropriate through the use of generic Kd vs. pH relationships and selectivity coefficients derived from a geochemical model (U. S. EPA, 1996b) or including non-linearity and probabilistic, approaches (U. S. EPA, 1996a). Some factors which most affect dissolved metal concentrations are the total concentrations of metal in the soil, soil solution pH, organic matter content, and the presence of iron and manganese oxides (Sauve et al., 2000b). Redox conditions are also important. Distribution coefficients of a metal can vary over several orders of magnitude for given pH, total metals in soil or organic matter content. Given the multivariate influences that affect metal concentration in solution, it is unlikely that empirical approaches alone will be successful in predicting metal transport at a particular contaminated site (Sauve et al., 2000a). There are however, some advantages of the Kd based model approach which include: • Simple and easy to include in transport • Retardation concept is easily understood • Works best for weakly sorbing, low concentration, contaminants which participate in few reactions and where chemical conditions and pH do not vary.	

Number	Comments	Response
329 (cont.)	Some disadvantages of the Kd based model approach include: • simplistic and compromises the role of geochemistry • can only simulate one solute at a time (Zhu and Anderson, 2002) • assumes an unlimited number of sorption sites and does not include competition • a site specific Kd does not ensure correct assessment of fate under transient system conditions • changes in aqueous speciation and temporal variations are not accommodated (Langmuir, 1997) • typically overestimate plume advance and underestimate "tailing" (Brady and Bethke, 2000)The characterization requirements for contaminated sites which contain metals and radionuclides, in either soil or groundwater should be enhanced to include geochemical measurements of groundwater and characterization of all solid phases and aquifer mineralogy. This has not been done at NFSS. Screening level and detailed risk assessments for the migration of metals in groundwater should be supported by geochemical calculations and reactive transport modeling. Kd-based transport models should not be relied on as the only modeling tool unless the very specific conditions for Kd use can be demonstrated at the site. The minimum approach for screening metals-contaminated sites should include use of equilibrium models (e.g. MINTEQA2) to identify potential reactions, characterization of mineral phases present and provide an opportunity to verify that reactions are actually occurring. In general, for an important site such as NFSS, simple coupled reactive transport models, or even more sophisticated models, could be applied to better understand issues of metal/radionuclide transport.	

Number	Comments	Response
330	Groundwater Model (HGL 2007). It appears that the same Kd value was used in all of the model layers. This is inappropriate as each layer will have different lithology and other characteristics.	The model accounts for flow and transport in 5 lithologic units; however, source terms were prescribed in the upper clay till only. A conservative value of K_d was assigned to the lower units to represent sorption in lieu of site-specific data.
331	Groundwater Model (HGL 2007). Sec 4.4.3.4 The model calculations for organic contaminants which include a biodegradation rate should only be considered to be for information or bounding purposes rather than a simulation of likely behavior. Additional site-specific information would need to be collected and evaluated in order to provide confidence that the model decay rates are reasonable for site conditions, and that NFSS aquifer conditions would remain conducive for continued biodegradation in the future. Inclusion of a no-decay case would be useful to bound the likely behavior of the organic contaminants.	Tetrachloroethene decay chain half-life was the median value shown in Table 3.1, pp 3-7 of Natural Attenuation of Chlorinated Solvents and Cost Results from Multiple Air Force Demonstration Sites (AFCEE 1999). This technical memorandum summarizes the results of natural attenuation treatability studies conducted at 14 Air Force sites in the continental United States. The selected value of 2.6e-4 is in agreement with the expected range of values for trichloroethylene (2e-4 to 8e-2 /day) and vinyl chloride (6e-4 to 8e-2 /day) reported in Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater" (EPA 1998). Thus the values of biodegradation assigned in the model, though not site-specific, are deemed reasonable and represent our best approximation of the biodegradation rates. This can be further evaluated during subsequent simulations performed as part of the FS.

Number	Comments	Response
332	Groundwater Model (HGL 2007). Sec 4.4.3.5 Use of the MINTEQA2 geochemical model is appropriate to estimate the solubility of elements and complexes at NFSS. However, it appears that the methodology used involved the measured geochemistry of only one groundwater sample (Appendix D). The selected well was OW04B, completed in the upper clay till. Unfortunately there are no other geochemical analyses presented for the upper water-bearing zone, or the lower water-bearing zone, so there is no confidence that the one selected geochemical analysis is in fact representative of groundwater at NFSS. In addition, Table 3 of Appendix D does not indicate the critical parameters pH, dissolved oxygen or redox conditions at which the simulations were performed. The mineralogy of the NFSS aquifers is not documented.	The MINTEQ modeling was performed based on the groundwater chemistry of OW04B, which is summarized in Table 3 of Appendix D of the groundwater modeling report (USACE 2007c). Section 3.1 Appendix D provides justification for basing the MINTEQ modeling on groundwater from OW04B exclusively. OW04B is located downgradient of the IWCS and is a shallow well screened in the upper clay till. In addition, the May 2003 sampling data for this well comprise a fairly complete chemical characterization of the groundwater. The report notes that use of a single representative groundwater sample typically provides a more realistic estimate of geochemical conditions than a composite groundwater sample compiled from statistical averages. Nevertheless, the representative groundwater sample collected from OW04B (Sample 3290; collected on May 15, 2003) was compared with samples from two nearby wells (OW15B and A42) and confirmed that the chemical characteristics were very similar (and generally reflect site-wide average conditions). Values of pH, dissolved oxygen and redox conditions are not listed in Table 3. The value of pH, however, is listed in the text as 7.4 (second paragraph, Section 3.1).

Number	Comments	Response
333	Groundwater Model (HGL 2007). Sec 4.6 An explanation for the choice of parameters subject to sensitivity analysis should be provided. The variation in Kd only involved the increase in value. The site-specific work by (Seeley, 1984) also indicated that laboratory derived distribution coefficients were as low a 1.1. Testing a lower Kd would help assess poor sorption (faster migration) conditions.	As stated in Section 4.6 of the Groundwater Model, the parameters used in the sensitivity analysis were selected on the basis that they are key transport parameters. These parameters include solubility limit, dispersivity (the tendency to break into finely divided particles or droplets), recharge, porosity and distribution coefficient (K_d). The sensitivity of model predictions to the distribution coefficient focused on uranium transport. Two values were evaluated for comparison to results from the baseline case, which was run using a distribution coefficient value of 3.6 L/kg for uranium. The rationale for selection of the two sensitivity values is summarized below. The first K_d sensitivity value, 8.7 L/kg, was taken from Table 1 of the geochemical determination of NFSS K_d values conducted by Seeley and Kelmers (1984). This value represents the average of three results for NFSS site samples of brown clay backfill using an initial uranium concentration of 6 mg/L. Although greater than the baseline case value of 3.6 L/kg, 8.7 L/kg is low compared to reported literature values. Seeley and Kelmers (1984) state that the NFSS soil and groundwater systems do not exhibit favorable conditions for uranium retardation and specifically cite the combined effect of high solubility and poor sorption conditions. The second K_d sensitivity value, 46 L/kg, was taken from Thibault et al. (1990), a frequently cited compilation of K_d values from previous studies, journal articles, and government lab reports. For clay, Thibault et al. (1990) reported K_d values ranging from 46 to 395,100 L/kg with a geometric mean of 1600 L/kg. To be conservative, the value representing the minimum was used in the sensitivity analysis. A lower value, such as 1.1 L/kg was not included as part of the analysis. The low values determined by Seeley and Kelmers (1984) were performed under conditions of very high uranium concentrations which are not representative of probable transport conditions at the NFSS. Literature values further attest that the baseline value of 3.6 L/kg is highly conservative.

Number	Comments	Response
334	Groundwater Model (HGL 2007). Conclusions. The development of the hydrogeologic modeling tools has been undertaken in a very thorough and thoughtful manner. With the exception of comments noted above, considerable insight into the behavior of ground water and solute transport from the IWCS is possible. Due to disagreement over the applicability and meaningfulness of the use of Kd values without further geochemical insight, the predicted times of migration and concentration values should not be accepted as accurate. Since there is disagreement over the solute transport issues, the understanding and interpretation of groundwater flow based on the model could have received more emphasis. In particular, since large drainage ditches are located so close to the IWCS, the potential for groundwater discharge to surface water would appear to be high. This seems to be a higher and faster source of risk exposure that has not been fully discussed in the report.	It is recognized that there is uncertainty in the model predictions. This uncertainty was addressed through the assignment of conservative transport parameters, completion of a sensitivity analysis, and the simulation of several worse-case predictive scenarios. This information regarding model uncertainty will be considered when developing and evaluating remedial options during the FS. The migration of contaminants to surface water was addressed during the modeling analysis. Contaminant mass-loading rates were predicted using the model. This information will be included in an addendum to the RIR (RIR Addendum, Appendix 12-I).

References

Acres American Inc., 1981. Hydrologic and Geologic Characterization of the U.S. Department of Energy - Niagara Falls Storage Site. Prepared for: Nation Lead of Ohio, Inc. Fernald, Ohio. Ala, N.K. and P.A. Domenico.

Air Force Center for Environmental Excellence (AFCEE) 1999. Natural Attenuation of Chlorinated Solvents Performance and Cost Results from Multiple Air Force Demonstration Sites, Technology Demonstration Technical Summary Report. Prepared for AFCEE, Technology Transfer Division, Brooks Air Force Base. Prepared by Parsons Engineering Science, Inc. October 1999 http://www.afcee.af.mil/shared/media/document/AFD-071211-005.pdf.

Bechtel (1986) Niagara Falls Storage Site 1985 Construction Report , July 1986.

Bechtel Civil and Minerals, Inc. 1989. *Groundwater Monitoring, Sampling and Analysis Plan, Model City Treatment/Storage/Disposal/Recycle Facility*, Model City, New York' dated October 1989.

BRA: USACE 2007b. Baseline Risk Assessment for the Niagara Falls Storage Site. Prepared for the Corps by Science Applications International Corporation. December 2007.

Department of Energy (DOE) 1986. "*Results of Radiological Measurements Taken in the Niagara Falls, New York, Area (NF002)*, November 1986.

DOE 2010. "*NFSS Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches*". Available at: http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx.

Department of Energy (DOE) 2010. Niagara Falls Storage Site Vicinity Properties, New York: Review of Radiological Conditions at Six Vicinity Properties and Two Drainage Ditches, DOE Office of Legacy Management, http://www.lm.doe.gov/Niagara/Vicinity/Documents.aspx. March 2010.

EA ES&T 2008. Final Report of Results for the Remedial Investigation of Underground Utility Lines Formerly Used by the Department of Defense, Lake Ontario Ordnance Works (LOOW), Niagara County, New York. Prepared for U.S. Army Corps of Engineers Baltimore District, September 2008.

EA Engineering, Science, and Technology, Inc. [ES&T] 2008. Report of the Results for the Investigation of Underground Utility Lines Formerly Used by the Department of Defense, Lake Ontario Ordnance Works, Niagara County, New York. November 2008

Environmental Protection Agency (EPA) 1989. *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A* Interim Final, December 1989

EPA 1991. *Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals* Office of Research and Development, Washington, D.C. December 1991.

EPA 1997. *Exposure Factors Handbook, Volumes I-III*, Office of Research and Development, Washington, D.C. August 1997.

Environmental Protection Agency, 2007. Radiation: Risks and Realities, Understanding Radiation in Your Life, Your World. Office of Air and Radiation, EPA-402-K-07-006, http://www.epa.gov/rpdweb00/docs/402-k-07-006.pdf.

Freeze, A. and J. Cherry, 1979. *Groundwater*. Prentice-Hall, New York.

Groundwater Model: USACE 2007c. Draft Final Groundwater Flow and Contaminant Transport Modeling Report. Niagara Falls Storage Site. Lewiston, New York. Prepared for the Corps by HydroGeoLogic Inc. (HGL) December 2007. Also referenced as HGL 2007 in some comments.

Oak Ridge National Laboratories (ORNL) 2001. Risk Assessment Information System. Chemical Specific Factors: http://risk.lsd.ornl.gov/.

Niagara County Department of Health 2006. Summary Report for Private Water Well Project, Towns of Lewiston and Porter, Niagara County, New York, Available on the internet at: http://www.niagaracounty.com/docs/loowrpt.PDF. March 2006.

RIR: USACE 2007a. Remedial Investigation Report for the Niagara Falls Storage Site. Prepared for the Corps by Science Applications International Corporation. December 2007.

RIR Addendum: USACE 2010. Draft Revision 1- Remedial Investigation Report Addendum for the Niagara Falls Storage Site. Prepared for the Corps by Science Applications International Corporation. April 2010.

SAIC, 2003. *Gamma Walkover Survey and Geophysical Survey of the Niagara Falls Storage Site,* Volumes I and II, May 2003.

Seeley, F. G. and A.D. Kelmers, 1984. *Geochemical Information for Sites Contaminated with Low-Level Radioactive Wastes: I – Niagara Falls Storage Site*, Oak Ridge National Laboratory (ORNL) Oak Ridge Tennessee, November 1984.

Tetra Tech 2009. *Results of Investigation and Drum Removal, Vicinity Property G, Niagara Falls Storage Site, Lewiston, New York*. Final Report, January 2009.

Tetra Tech, 2009. *Results of the Site Investigation and Drum Removal Vicinity Property G* Work performed for the Buffalo District USACE, January 2009.

USACE, 2008. *"Report on the Documentation and Data Gaps Relevant to the Containment of Radioactive Residues in the IWCS"* (2008, USACE: Letters 4-11 to 5-4-2008).

USACE 2009. Niagara Falls Storage Site Historical Photographic Analysis, Lewiston Township, New York. US Army Geospatial Center, Operation Division, Hydrologic & Environmental Analysis, Alexandria, Virginia. Final. September 2009.

Unites States Army Corps of Engineers (USACE) 2009. Environmental Surveillance Technical Memorandum for 2008 *(December 18, 2007 to December 17, 2008)*, November 2009.

United States Environmental Protection Agency (EPA) 1989. *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A* Interim Final, Office of Research and Development, Washington, D.C. December 1989.

Wehran Engineering 1979. *Engineering Report of the Modern Landfill, Inc. Sanitary Landfill.* Prepared for Modern Landfill, Inc., August 1979

Wehran Engineering 1990. *Supplemental Hydrogeologic Investigation for Modern Landfill, Inc.* Report and Plans prepared for Modern Landfill, Inc., April 1990

White Engineering, 1943. *Lake Ontario Ordnance Works Completion Report*, Youngstown, New York. Office of Area Engineer, January 1, 1942-March 15, 1943