FUSRAP
NIAGARA FALLS STORAGE SITE

2007

(January 09, 2007 to December 18, 2007)

ENVIRONMENTAL SURVEILLANCE TECHNICAL MEMORANDUM

US Army Corps of Engineers ®
Buffalo District

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ACRONYMS

ALARA	as low as reasonably achievable
ANL	Argonne National Laboratory
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
CAP88-PC	Clean Air Act Assessment Package – 1988 (USEPA)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DCG	derived concentration guide
EML	Environmental Measurements Laboratory
ESP	environmental surveillance plan
FFA	federal facility agreement
FSRD	Former Sites Restoration Division
FUSRAP	Formerly Utilized Sites Remedial Action Program
IG	instruction guide
IWCS	interim waste containment structure
LWBZ	Lower Water Bearing Zone
MCL	maximum contaminant level
MDA	Minimal Detectable Activity
MED	Manhattan Engineer District
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants (USEPA)
NFSS	Niagara Falls Storage Site
NIST	National Institute for Standards and Technology
NPDES	National Pollutant Discharge Elimination System
NYSDEC	New York State Department of Environmental Conservation
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RPD	relative percent difference
SDWA	Safe Drinking Water Act
TDS	total dissolved solids
TETLD	tissue-equivalent thermo luminescent dosimeter
TLD	thermo luminescent dosimeter
USACE	United States Army Corps of Engineers
USAEC	United States Atomic Energy Commission
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USNRC	United States Nuclear Regulatory Commission
UWBZ	Upper Water Bearing Zone

EXECUTIVE SUMMARY

Purpose: The purpose of this Technical Memorandum is to document the scientific methods, criteria, data, and findings of the Environmental Surveillance Program at the Niagara Falls Storage Site (NFSS). The environmental surveillance program quantifies and evaluates radiological, chemical, and water quality data from the environment at the NFSS. This program is executed by the U.S. Army Corps of Engineers (USACE) Buffalo District in support of our mission to protect human health and the environment at the NFSS. This Technical Memorandum is published annually by the Buffalo District.

Key Findings: This Technical Memorandum documents the evaluation of environmental data collected at the NFSS throughout the calendar year 2007. The Corps evaluation of this data indicates that measured parameters were within U.S. Department of Energy (USDOE) guidelines and calculated exposure rates to the general public were well within regulatory limits. The 2007 data confirm site controls are continuing to perform as designed and are fully protective of human health and the environment. These findings are consistent with findings from over 20 years of environmental monitoring at the NFSS.

Site Description: The NFSS is located at 1397 Pletcher Road in the Town of Lewiston, NY, approximately 19 miles north of Buffalo, NY. The NFSS is a federally owned property 191 acres in size. The NFSS was originally part of a World War II explosives plant called the Lake Ontario Ordnance Works (LOOW) which was approximately 7,500 acres in size. Between 1944 and 1954 the Manhattan Engineer District (MED) and the Atomic Energy Commission (AEC) brought radioactive wastes and residues to the LOOW site. Through the 1970s the AEC gradually consolidated its operations and sold excess property to the public. In the 1980s the USDOE constructed a 10-acre Interim Waste Containment Structure (IWCS) on the NFSS to contain the radioactive wastes and residues.

Background: In 1974, the AEC, a predecessor to the USDOE, instituted the Formerly Utilized Sites Remedial Action Program (FUSRAP). This program is now managed by the USACE to identify and clean up sites where residual radioactivity remains from the early years of the nation's atomic energy program or from commercial nuclear operations that Congress has authorized to be remediated under FUSRAP. In October 1997, Congress transferred the responsibility for FUSRAP from the USDOE to the USACE. In addition to investigating and remediating site contaminants at the NFSS, the USACE has been given responsibility for maintaining the site and conducting the environmental surveillance program.

The environmental surveillance program at the NFSS was initiated by the USDOE in 1981 to monitor radioactive waste and residues stored onsite in an interim waste containment structure (IWCS). The program included the sampling of air, water, and sediments for radiological and chemical parameters with the purpose of ensuring that the NFSS did not pose a threat to human health and the environment. The USACE has continued to follow the

USDOE program with some revisions over the years. Further modification of the program will be reflected in the next year's reporting period to reflect the results of the recently completed Remedial Investigation Report (December 2007).

Prior to transfer of the FUSRAP to USACE in 1997, the USDOE prepared reports based on USDOE Orders and guidance. USDOE Orders are not applicable to the activities of the USACE as the USACE is not under the authority or direction of the USDOE. However, the surveillance data continues to follow a format similar to that of the previous USDOE reports to provide the reader with consistent presentation of data and to facilitate historical comparison between reports.

Additional information about the site and the environmental surveillance program is available on the USACE Buffalo District website:
http://www.lrb.usace.army.mil/fusrap/nfss/index.htm

Scope: The 2007 Environmental Surveillance Technical Memorandum presents the results of data obtained from samples collected during the 2007 monitoring program. To assess the data, the report compares the surveillance data with local background conditions and regulatory criteria. The structure of the report follows the format of previous USDOE reports to provide the reader with a consistent presentation of the data and to facilitate the interpretation of historical trends.

The Technical Memorandum provides a comparative analysis of local background conditions and regulatory criteria to results reported for external gamma radiation and for samples from the media investigated (including airborne radon gas, airborne particulates, surface waters, sediments, and groundwater). Data tables and figures referenced in the text are included at the end of the Technical Memorandum.

Evaluation of Data: The USDOE and USEPA guidelines are cited throughout this report to aid in the evaluation of environmental data. This memorandum compares data with USDOE guidelines because the USDOE has "property accountability" for the site. The guideline values do not represent cleanup criteria of a long term remedy for the contaminants at the NFSS.

Results of the 2007 surveillance program at NFSS continue to show that measured parameters of the surveillance program did not exceed USDOE guidelines and, dose rates of potential offsite radiation exposure to the public did not exceed USDOE or USEPA limits.

Radiological parameters including uranium, thorium, and radon isotopes in air, surface water, and sediments were all within USDOE limits, and radon flux measurements from the IWCS were within USEPA standards. Groundwater concentrations of radiological parameters were also well below USDOE guidelines.

Total uranium levels in groundwater were found to exceed the U.S. Environmental Protection Agencies (USEPA) safe drinking water concentration limits (SDWA MCL's) at two monitoring well locations. Since the NFSS is not a source of drinking water, MCLs are presented for comparative purposes only. Analytical results for sodium and sulfates, as observed in previous reports, were found to be consistently above NYS Department of Environmental Conservation (NYSDEC) groundwater standards in onsite wells and background samples.

Long-Term Remedy: In addition to executing the environmental surveillance program at the NFSS, the USACE Buffalo District is executing an environmental investigation to determine the long-term remedy for the contaminants at the NFSS. This investigation is being conducted in accordance with the federal cleanup process created by Congress and developed by the USEPA. This process was authorized under the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A summary of this process and the anticipated schedule for completion at the NFSS is provided below *(Note: the anticipated long term schedule is subject to change depending on many factors including annual funding, public input, and execution of work):*

The nature and extent of contamination and an assessment of associated risks are documented in the Remedial Investigation Report which was published in December 2007. The results of this investigation are being used to enhance the environmental surveillance program to ensure the site is continually and fully protective of human health and the environment surrounding the NFSS.

- A range of long-term remedies will be evaluated in a Feasibility Study through 2009 and 2010

- The USACE will identify and document a preferred long-term remedy (the Proposed Plan) in the 2011 timeframe

- After public comment on the Proposed Plan, the USACE will select a long-term remedy and document this decision in a Record of Decision (ROD) in the 2012 timeframe

- Following completion of the ROD, the USACE will implement the long-term remedy through remedial design, construction, operations, and long term monitoring beginning in the 2013 timeframe

1.0 INTRODUCTION

The Niagara Falls Storage Site (NFSS) is located in the Town of Lewiston in northwestern New York State, northeast of Niagara Falls and south of Lake Ontario (Figure 1, Appendix A). NFSS is approximately 77 hectare (191 acre) site which includes: one former process building (Building 401), one office building (Building 429), an equipment shed (Hitman Bldg), a new storage shed for maintenance equipment, and a 4 hectare (9.9 acre) interim waste containment structure (IWCS). The property is fenced, and public access is restricted.

Land use in the region is primarily rural residential; however, the site is bordered by a state and federally regulated chemical waste disposal facility to the north, a solid waste disposal facility to the east and south, and a National Grid Power Corporation right-of-way to the west. The nearest residential areas are approximately 1-km southwest of the site; the residences are primarily single-family dwellings.

Beginning in 1944, the NFSS was used as a storage facility for radioactive residues and wastes. The residues and wastes are the process by-products of uranium extraction from pitchblende (uranium ore). The residues originated at other sites and were transferred to the NFSS for storage in buildings, onsite pits, and surface piles.

Since 1971, activities at NFSS have been confined to residue and waste storage and remediation. Onsite and offsite areas with residual radioactivity exceeding USDOE guidelines, were remediated by the USDOE between 1955 and 1992; materials generated during remedial actions (approximately 195,000 m^3) are encapsulated in the IWCS, which is specifically designed to provide interim storage of the material.

1.1 Measured Parameters

The key elements of the 2007 environmental surveillance program at NFSS were:

- measurement of external gamma radiation;
- measurement of radon gas concentrations in air (combined contributions from radon-220 and radon-222);
- monitoring of radon-222 flux (rate of radon-222 emission from the IWCS);
- calculation of external gamma dose to off-site receptors from radiation originating at the site (Appendix B);
- analysis of airborne emissions from site soils and resultant doses to off-site receptors (Appendix C);
- sampling and analysis of surface water for isotopic uranium (U-234, U-235, U-238) and total uranium (sum of these three isotopes), isotopic thorium (Th- 230, Th-232) and isotopic radium (Ra-226, Ra-228) (referred to collectively as radioactive constituents);
- sampling and analysis of streambed sediments for radioactive constituents; and
- sampling and analysis of groundwater for radioactive constituents, metals, and water quality parameters.

1.2 Unit Conversions

The tables in Appendix A (Table A.1& A.2, Page T-1) list the units of measurement and appropriate abbreviations used in this document. Conventional units for radioactivity are used because the regulatory guidelines are generally provided in these terms.

2.0 REGULATORY GUIDELINES

The primary regulatory guidelines that affect activities at Formerly Utilized Sites Remedial Action Program (FUSRAP) sites are found in Federal statutes and in Federal, State, and Local regulations. Regulatory criteria that were used to evaluate the results of the 2007 environmental surveillance program at NFSS are summarized below, categorized by media and parameters. In several cases USDOE guidelines continue to be identified in the technical memorandum for comparison purposes of historical data collected by USDOE or their contractors. USACE is not under the authority of the USDOE orders or directives and must rely on other applicable Federal or State regulations in relation to surveillance of the IWCS. The values are for comparison only.

2.1 External Gamma Radiation and Air (Radon Gas and Airborne Particulate)

The regulatory guideline criteria used in evaluation of the calculated maximum doses from external gamma radiation and inhalation of radioactive particulate and the measured concentrations of radon gas include USDOE guidelines, United States Environmental Protection Agency (USEPA) standards, and USEPA guidance.

2.1.1 USDOE Order 5400.5

Dose limits for members of the public from USDOE operations at USDOE-owned and USDOE-operated facilities are presented in this USDOE Order. The primary dose limit is expressed as an effective dose equivalent. The limit of 100-mrem total effective dose equivalent above background in a year from all sources (excluding radon) is specified in this Order; external gamma radiation dose and the calculated doses from airborne particulate releases are included in the calculation of the effective dose equivalent total. Also, this calculation includes contributions from other pathways, such as ingestion.

USDOE limits for radon concentrations in air from USDOE operations at USDOE-owned and USDOE-operated facilities are also presented in Order 5400.5. Based on the radioactive constituents in the wastes contained in the IWCS, it is unlikely that radon-220 would be emitted from the IWCS since the radon-220 half-life is approximately 55.6 seconds and this isotope would decay prior to permeating through the IWCS cap. It is, however, possible that radon-222 with a half-life of 3.8 days could be emitted. The USDOE limits for radon-222 concentrations in the atmosphere above facility surfaces or openings in addition to background levels are: 100 pCi/L at any given point; an annual average concentration of 30 pCi/L over the facility site; and an annual average concentration of 3.0 pCi/L at or above any location outside the facility site. To provide a conservative basis for comparison, on-site radon concentrations are evaluated against the off-site limit of 3.0 pCi/L.

2.1.2 USEPA Standards and USEPA Guidance

Radon

The USEPA also has a guidance action level of 4.0 pCi/L for radon concentrations for indoor air (homes and buildings), providing another conservative basis for comparison. Although these limits are specific to indoor air, they provide a conservative basis for comparison to the outdoor air results obtained during environmental surveillance activities, for details see Appendix C. For further comparison, the average radon level in US homes is about 1.25pCi/L and the average outdoor value is 0.4 pCi/L (USEPA 1993).

Clean Air Act

Section 112 of the Clean Air Act authorized the USEPA to promulgate the National Emission Standards for Hazardous Air Pollutants (NESHAPs) which are given in 40 CFR 61. Compliance with Subpart H (for non-radon, radioactive constituents) is verified by applying the USEPA-approved CAP88-PC model. Compliance with Subpart Q is verified by annual monitoring of the IWCS for radon-222 flux (Appendix A, Table B, Page T-1).

2.2 Sediment, Surface Water, and Groundwater - Radioactive Constituents

Regulatory criteria (Appendix A, Table C, Page T-2), for evaluating the measured concentrations of radionuclides in sediment, surface water, and groundwater at NFSS are as follows.

2.2.1 USDOE Order 5400.5

This Order provides guideline limits for radioactive contaminants in water and soil at USDOE-owned and USDOE-operated facilities. These limits are known as the USDOE derived concentration guide (DCG). The USDOE DCG for drinking water is used to compare against those radiological findings for surface water and groundwater. USDOE historically applied the residual soil cleanup guideline criteria specified in USDOE Order 5400.5 to sediments. However, those values are provided for comparative purposes only. ARARs and media-specific cleanup goals will be evaluated independently and presented in future CERCLA decision documents that will be available for public comment.

Section 5.5 presents the data for this 2007 technical memorandum and describes the basis for comparisons with USDOE Order 5400.5 limits in detail.

2.2.2 Safe Drinking Water Act (SDWA)

The Safe Drinking Water Act (SDWA) is the primary Federal law applicable to the operation of a public water system and the development of drinking water quality standards [*USEPA Drinking Water Regulations and Health Advisories* (*USEPA* 1996)]. The regulations in 40 CFR Part 141 (National Primary Drinking Water Regulations) set maximum permissible levels of organic, inorganic, radionuclides (including uranium and combined radium) and microbial contaminants in drinking water by specifying the maximum contaminant level (MCL) for each. In some cases, secondary maximum contaminant levels (SMCLs), which are not federally enforceable (40 CFR 143.1), are provided as guidelines for the states. SMCLs are provided for a conservative comparison of analytical results and to provide consistency with previous reports and facilitate trend analysis

The established (promulgated) MCL for combined concentrations of radium-226 and radium-228 is 5 pCi/L. The USEPA National Primary Drinking Water Regulation for Radionuclides (Final Rule – effective 2003) states a MCL of 30 µg/L for total uranium. Thorium 230 and 232 utilize an adjusted gross alpha MCL of 15 pCi/L, excluding radon and uranium (National Primary Drinking Water Regulations; Radionuclide; Final Rule (Federal Register 7, 2000)).

Although groundwater at NFSS is not a public drinking water supply, MCLs for drinking water are used as a conservative basis for evaluation of analytical results, maintaining consistency with previous reports and facilitating trend analysis (Table C in Appendix A, TABLES section, page T-2).

2.3 Groundwater – Water Quality

Shallow groundwater resources at NFSS demonstrate uniformly poor groundwater quality and availability in the general region. Regional studies and studies conducted near the site (La Sala 1968; Wehran 1977; Acres American 1981) conclude that groundwater quality is poor near the site because of high mineralization (see section 5.6.2.2 Water Quality Parameters). Additionally, local studies (Wehran 1977 and Acres American 1981) indicate that the permeabilities of the shallow groundwater systems are sufficiently low that it is not practicable to obtain groundwater from these systems for water supply. Onsite permeability testing at NFSS confirms the low permeabilities.

The USDOE conducted a well survey in 1988 and inventoried eight wells within 4.8 km of the site, none of which were reported as drinking water but mainly irrigation (USDOE 1994b). In 2007, the Niagara County Department of Health (DOH) updated its well inventory to include 9 potable wells (two of which were sole source), 8 non-potable wells, 20 abandoned wells and 77 idle wells within the survey area. Based on the USDOE report and recent DOH survey the NYSDEC Class GA groundwater standards represent a

conservative basis for comparing analytical results. Groundwater at NFSS consistently exceeds sodium and sulfate Class GA standards. Both the shallow and deep groundwater units at the NFSS exhibit over 1000 mg/L Total Dissolved Solids (TDS) and the deep groundwater commonly over 100 mg/L Chloride, which indicates that the site groundwater can be classified as saline or Class GSA (NYCRR 701.16). However, to establish a basis for comparison of analytical results, Class GA (groundwater) water quality standards for some constituents were obtained from the NYSDEC document.

Although groundwater at NFSS is not a public drinking water supply, State and Federal standards (Appendix A, Table D, pg. T-3) are used as a basis for evaluation of chemical analytical results.

2.3.1 New York State Department of Environmental Conservation (NYSDEC) Water Quality Criteria for Groundwater

NYSDEC has adopted the Federal SDWA standards into its own regulations in Title 6 New York Codes of Rules and Regulations (NYCRR) Parts 700-705, "Water Quality Regulations for Surface and Groundwater" (NYSDEC 1996). In addition, NYSDEC has independently established standards for some constituents. To apply established standards, the State of New York categorizes groundwater resources by groundwater quality and use.

The Division of Water Technical and Operational Guidance Series (TOGS) specifically address source drinking water standards (NYSDEC –6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations (August 1999)). These standards have been used to establish additional Class GA (related, conservative case) state water quality standards for comparison of analytical results.

3.0 SAMPLING LOCATIONS AND RATIONALE

Radioactive materials that exceed USDOE cleanup guidelines at NFSS are stored in the IWCS. Exposure of members of the public to this radioactively contaminated material at NFSS is unlikely because of site access restrictions (e.g., fences) and engineering controls (e.g., pile covers). However, potential pathways to residual radioactivity that may exist outside the IWCS include direct exposure to external gamma radiation and inhalation of air containing radon or radioactively contaminated particulates from site soils; and contact with, or ingestion of, contaminated surface water, streambed sediments, or groundwater. The environmental surveillance program at NFSS has been developed to provide surveillance of these exposure routes through periodic sampling and analysis for radioactive and chemical constituents. Figure 2 (Appendix A, pg. F-2) presents sampling locations and media associated with the environmental surveillance program at NFSS. Figure 1 (Appendix A, pg. F-1) shows those background locations for external gamma, radon gas and radon flux (radon-222) monitoring. A summarization of the environmental surveillance program at NFSS for external gamma radiation, radon gas, radon flux, surface water, sediment, and groundwater can be found in Appendix A, Tables 1a-c, pages T-4 thru T-6.

External gamma radiation monitoring and radon gas measurements occur at fence line locations surrounding the NFSS as well as interior portions of the site, including the perimeter of the IWCS, to assess potential exposures to the public and site workers. Measurement of radon-222 flux is conducted annually at discrete grid intersections on the IWCS. See Appendix A, Figure 2, pg. F-2 for radiological monitoring (gamma and radon) locations at the site and radon-222 sample locations on the IWCS.

Groundwater monitoring wells have been selected to assess groundwater quality in areas representing background, potential source-areas (e.g., near the IWCS and past radiologic materials storage areas), and down gradient (on-site) areas in the upper water-bearing zone (Appendix A, Figure 2, page F-2). Groundwater monitoring includes analysis for radioactive constituents, water quality parameters, and metals. Monitoring wells screened in the upper water-bearing zone (Appendix A, Figure 7, page F-7) would provide the earliest indication in the unlikely event of a breach of the IWCS. The glacio-lacustrine clay aquitard that hydraulically separates the upper and lower water-bearing zones will mitigate potential contaminant transport into the lower zone. The lower groundwater system was not monitored because past analytical results and recent Remedial Investigation (RI) results indicate there are no groundwater contaminant plumes, or constituents in excess of MCLs, in the lower water-bearing zone. However, to ensure that RI findings represent baseline conditions in the lower water-bearing zone, well OW4A will be included in the environmental surveillance program, starting in 2008, as a down-gradient monitoring point for the IWCS.

Surface water and streambed sediment sampling of radioactive constituents is conducted along the drainage ditch system in upstream, onsite, and downstream locations (Appendix A, Figure 2, page F-2) to assess the migration of constituents in these media should any occur.

4.0 SURVEILLANCE METHODOLOGY

Under the NFSS environmental surveillance program, standard analytical methods approved and published by USEPA and the American Society for Testing and Materials (ASTM) are used for chemical (i.e., all non-radiological) analyses. The laboratories conducting the radiological analyses adhere to USEPA-approved methods and to procedures developed by the Environmental Measurements Laboratory (EML) and ASTM. A detailed listing of the specific procedures and the data quality objectives for the surveillance program is provided in the *Environmental Surveillance Plan* (BNI 1996a).

All 2007 environmental surveillance activities at NFSS were conducted in accordance with the *Environmental Surveillance Plan* (USACE 2000) and surveillance methodology listed in Appendix A (Table E, page T-3).

5.0 ANALYTICAL DATA AND INTERPRETATION OF RESULTS

This section presents the data and interpretation of results for the environmental surveillance program at NFSS. Data for 2007 are presented in Tables 2 through 10 (Appendix A). Trend graphs, summarizing analytical results for air, streambed sediment, surface water and groundwater for 2007 and the preceding ten years, are presented in Figures 9 through 26 (Appendix A).

In data tables containing analyses for radioactive constituents, some results may be expressed as negative numbers. This phenomenon occurs when the average background activity of the laboratory counting instrument exceeds the measured sample activity. A negative result is generated when the instrument background activity is subtracted from the sample activity. For the purposes of interpretation, all values below the minimum detectable activity (MDA) are interpreted as having an unknown value between zero and the MDA. Therefore, a result below the MDA is referred to as a non-detected result in the text discussion.

Gross data results for surface water, sediment, and groundwater are compared to the USDOE soil guideline limits (for sediment) and DCGs (for surface water and groundwater), and are used in the assessment of potential impact. The analytical results including site background results are provided in the data tables. However, for simplicity of presentation, only the gross analytical results (without the background subtracted) are discussed in the text of this document.

Historical ranges in background concentrations for each radioactive analyte are determined from background sampling results from 1992 to 2007, unless otherwise noted. For gamma dose rates subtracting the calculated background from the sampling results for 2007 then gives an estimate of the above-background dose rate at each location; see Table 2 External Gamma Radiation Dose Rates (Appendix A, page T-7). When background is subtracted from the sampling result, it is possible that a negative number will be obtained much the same as a negative value may be obtained when the laboratory subtracts instrument background from a sample measurement.

On-site 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 on-site 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 these data, compiled for the RI, were comparable to historic groundwater concentrations from B02W20, this well was verified to be representative of on-site background conditions.

Some of the historical data from NFSS used a method for analysis of total uranium, which yields results in μg/L, and μg/g for water and sediment samples, respectively. To allow

direct comparison of results to the DCGs and soil guidelines, the data was converted to pCi/L and pCi/g, as appropriate. The specific activity for total uranium in drinking water sources has been estimated to be about 0.9 pCi/µg (USEPA 2000), which is the factor used to convert groundwater data from µg/L to pCi/L in this report. The specific activity for total uranium in soil sources is estimated to be 0.67 pCi/µg (USEPA 2000).

5.1 External Gamma Radiation

External gamma radiation dose rates are measured using thermo luminescent dosimeters (TLDs) continuously for the year. TLD results for the 2007 external gamma radiation dose (both raw and corrected data) are presented in Table 2 (Appendix A, Tables, External Gamma Radiation at NFSS).

The data are used to calculate the external gamma radiation dose rate at both the nearest residence and the nearest commercial/industrial facility to determine the hypothetical maximally exposed off-site individual (MEI). The dose rate is a function of the site fence line dose, the distance of the individual from the fence line, and the amount of time the individual spends at that location. Results of this calculation are expressed as a dose to the individual in mrem for the year.

Distances to off-site receptors are based on the findings of a year 2005 canvas of areas nearby the site. Based on external gamma radiation results, the hypothetical MEI is a resident located 500 feet from the western perimeter fence, southwest of the site that received a dose of 0.006 mrem for calendar 2007. The hypothetical dose to the nearest off-site worker located 1020 feet east of the site is 0.002 mrem for calendar year 2007. Appendix B, CY2007 CALCULATION OF EXTERNAL GAMMA RADIATION DOSE RATES FOR NIAGARA FALLS STORAGE SITE (NFSS), section 4.1 contains all pertinent calculations. External gamma dose rates from the NFSS and IWCS perimeters from 1998 thru 2007 are presented in Figures 9 and 10 of Appendix A. Both doses are well below the USDOE guideline of 100 mrem/year for all pathways, excluding radon.

5.2 Radon Gas

Radon monitoring at NFSS is performed at a level that is representative of the human breathing zone (1.7 meters above ground level). Radon concentration diminishes significantly as distance from the ground increases and mixing with ambient air takes place.

Based on the radioactive constituents in the wastes contained in the IWCS, it is unlikely that radon-220 would be emitted from the IWCS; however, it is possible that radon-222 would be emitted. Air surveillance is conducted to determine the concentration of radon gas at NFSS using Radtrak® detectors that are designed to measure alpha particle emissions from both isotopes of radon (radon-220 and radon-222) and to collect passive, integrated data throughout the period of exposure. Because radon-220 is not a contaminant of concern at

NFSS (due to the relatively low concentrations of radium-228 and the short half-life of radon-220), all concentrations are conservatively assumed to be radon-222. Results of semiannual monitoring for 2007 are presented in Appendix A, Table 3, pg T-8. The corresponding surveillance locations are shown in Appendix A, Figure 2, pg. F-2.

Consistent with results from previous years, all site radon-222 results from the 2007 environmental surveillance program were well below the USDOE off-site limit of 3.0 pCi/L above background. Results, presented are without background subtracted, ranged from non-detect (less than 0.2 pCi/L) to 0.7 pCi/L. The background locations results ranged from non-detect (less than 0.2 pCi/L) to 0.5 pCi/L. Site average of 0.48 pCi/L is comparable to that of the background average of 0.47 pCi/L and to that of the average outdoor value of 0.4 pCi/L (USEPA 1993). Radon concentrations at the NFSS perimeter for the 1st and 2nd half of the year are presented in Figures 11 and 12 respectively. Radon concentrations at the IWCS perimeter for the 1st and 2nd half of the year are presented by Figures 13 and 14 respectively.

5.3 Radon-222 Flux

Measurement of radon-222 flux provides an indication of the rate of radon-222 emission from a surface. Radon-222 flux is measured with activated charcoal canisters placed at 15-m grid across the surface of the IWCS for a 24-hour exposure period. Measurements for 2007 are presented in Table 4; measurement locations are shown in Figure 2, Appendix A.

Measured results for 2007 ranged from non-detect to 0.06571 pCi/m^2/s, with an average (of detects and non-detects) result of 0.02974 pCi/m^2/s (Appendix A, Table 4). Background were all non-detect at 0.05095, 0.00543 and 0.00700 pCi/m^2/s. As in previous years, these results are well below the 20.0 pCi/m^2/s standard specified in 40 CFR Part 61, Subpart Q, as well as comparable to background and demonstrate the effectiveness of the containment cell design and construction in mitigating radon-222 migration.

5.4 Airborne Particulate Dose

To determine the dose from airborne particulates potentially released from NFSS during 2007, airborne particulate release rates were calculated using Remedial Investigation soil data (collected between 1999 and 2004), and weather data for the year 2007 from the National Weather Service (Niagara Falls International Airport). Contributions from radon gas, which is not a particulate, are not considered in this calculation. The total airborne particulate release rate is input into the USEPA's CAP88-PC (Version 3.0) computer model to perform two calculations:

1. The first calculation estimates resultant doses from airborne particulates to hypothetical individuals at the distances to the nearest residences and to the nearest commercial/industrial facilities as measured from a central location onsite.

Hypothetical doses are then corrected for commercial/industrial facility occupancy at assumed rate of 40 hours/week for 50 weeks/year. Residential occupancy is assumed to be full-time (i.e., 24 hours/day and 365 days/year (366 days for a leap year)). The hypothetical individual receiving the higher of these calculated doses is then identified as the hypothetical MEI for airborne particulate dose.

2. The second calculation estimates the hypothetical airborne particulate collective dose to the population within 80 km of the site using a population file (2000 census data for New York State and 2001 census data for the Province of Ontario) to determine the number of people in circular grid sections radiating to 80 km from the center of site.

The first calculation (Appendix C) indicates that the 2007 airborne particulate dose to the hypothetical MEI, a home resident, 914 meters south-southwest of the site, was 0.00084 mrem. These values are well below the 10 mrem per year standard, individual dose, specified in 40 CFR, Part 61, Subpart H, and the USDOE Order 5400.5. The second calculation indicates that the hypothetical airborne particulate collective dose to the population within 80 km of the site was 0.026 person-rem. This compares to a yearly background dose to the same population of 3,150,000 person-rem, (see Figure 8, Appendix A). Details of the calculations, including methodology are presented in Appendix C (FUSRAP CY2007 NESHAP ANNUAL REPORT FOR NIAGARA FALLS STORAGE SITE (NFSS)).

5.5 Surface Water and Sediment

In 2007, annual surface water and sediment samples were collected at five locations: SWSD009 and SWSD021 at the upstream fence line; SWSD010 and SWSD022 onsite along the central drainage ditch; and SWSD011, downstream along the central drainage ditch. Surface water and sediment sampling location SWSD009 was selected as a background location because it is at the upstream boundary of the South 31 drainage ditch, which eventually joins the central drainage ditch. Surface water and sediment sampling location SWSD021 was selected as a background location because it is located upstream, along the NFSS fence line, where the central drainage ditch first enters the property. Sampling locations are presented in Figure 2, Appendix A.

Surface water and sediment samples were analyzed for radium-226, radium-228, thorium-230, thorium-232, uranium-234, uranium-235, and uranium-238. The 2007 environmental surveillance analytical results for surface water and sediment samples are presented in Appendix A, Tables 5 and 6, respectively. Analytical results for surface water in 2007 are compared with the USDOE DCGs for radium-226, radium-228, thorium-230, thorium-232, and total uranium (sum of the uranium-234, -235, and -238 isotopes). Because there are no established limits for sediments, USDOE historically used the surface soil criterion of 5 pCi/g as a basis of comparison of radium-226, radium-228, thorium-230 and thorium-232 analytical results, and the derived site-specific criterion of 90 pCi/g for total

uranium in surface soil.

Background concentrations were determined by averaging historical analytical results for the appropriate constituents at surface water/sediment sampling locations SWSD009 and SWSD021. For total uranium and radium-226, background concentrations include data from 1992 through 2007 for surface water and sediment. Because analysis for thorium-232 first began in 1995 in sediment and 1996 in surface water, background concentrations for thorium-232 were determined from analytical results from 1995 and/or 1996 through 2007, as appropriate. Similarly, background concentrations for radium-228 and thorium-230 were determined from analytical results beginning in 1997.

5.5.1 Surface Water

In 2007 as in previous years surface water analytical results were consistently less than the USDOE DCGs, and generally indistinguishable from the historical background (upstream) concentrations. In 2007, surface water analytical results were less than the SDWA MCLs. The 2007 radiological results for the surface water were generally slightly lower or comparable to past results with the exception of 2004 results for sampling location SWSD010 which were elevated due to the turbidity of the sample. Figure 2 (Appendix A, pg. F-2) shows those locations sampled for surface water. Measured results (on-site background locationsSWSD021 and SWSD009 not subtracted) are provided (Appendix A, Table 5, pg. T-11) and discussed below:

- The 2007 analytical results for radium-226 concentrations in surface water are consistent with historical results and are indistinguishable from on-site background. Radium-226 results from upstream (on-site background) locations SWSD009 and SWSD021 were both non-detect comparing favorably with the historical (1997 to present) background range of non-detect to 0.37 pCi/L. The 2007 results of analysis for radium-226 in samples collected at locations (SWSD010, SWSD011, and SWSD022) ranged from non-detect to 0.805 pCi/L. The radium-226 USDOE DCG is 100 pCi/L. Total radium (Ra-226 and Ra-228) concentrations in surface water are below the SDWA limit (5 pCi/L) and the USDOE DCG (100 pCi/L), as shown in Figure 15 from 1997 to 2007.

- The 2007 on-site analytical results for radium-228 concentrations in surface water are consistent with historical results and are indistinguishable from on-site background. Radium-228 results from on-site background locations SWSD009 and SWSD021 were both non-detect comparing favorably with the historical (1997 to present) on-site background range of non-detect to 1.02 pCi/L. The 2007 results for radium-228 in samples collected at locations (SWSD010, SWSD011, and SWSD022) were all non-detect. The radium-228 USDOE DCG is 100 pCi/L. Total radium (Ra-226 and Ra-228) concentrations in surface water are below the SDWA limit (5 pCi/L) and the USDOE DCG (100 pCi/L), as shown in Figure 15 from 1997 to 2007.

- The 2007 results for thorium-230 in on-site samples (SWSD010, SWSD011, and SWSD022) ranged from 0.329 to 0.718 pCi/L. Thorium-230 results from on-site background locations SWSD009 and SWSD021 were non-detect to 0.397 pCi/L comparing favorably with the historical (1997 to present) on-site background range of non-detect to 1.20 pCi/L from both background locations. Historical values for surface water SWSD009 are non-detect to 0.60 pCi/L which is considered to be more representative of on-site background. The thorium-230 USDOE DCG is 300 pCi/L. Thorium-230 concentrations in surface water are below the adjusted gross alpha MCL SDWA limit of 15 pCi/L and the USDOE DCG of 300 pCi/L, as shown in Figure 16 from 1997 to 2007.

- The 2007 on-site analytical results for thorium-232 concentrations in surface water ranged from non-detect to 0.516 pCi/L, compared to on-site background which were both non-detect. The historical (1997 to present) on-site background concentration for thorium-232 ranges from non-detect to 0.613 pCi/L. The USDOE DCG for thorium-232 is 50 pCi/L. Thorium-232 concentrations in surface water are below the adjusted gross alpha MCL SDWA limit (15 pCi/L) and the USDOE DCG (50 pCi/L), as shown in Figure 17 from 1997 to 2007.

- The 2007 on-site analytical results for total uranium in surface water, ranged from 3.81 to 4.56 pCi/L, which compares favorably against the on-site background range of 2.94 and 7.92 pCi/L. The historical (1997 to present) on-site background concentration for total uranium ranges from 1.8 to 25.56 pCi/L from both background locations or 1.8 to 8.67 pCi/L from surface water location SWSD009, which is considered to be more representative of background. As shown in Figure 18, concentrations of total uranium in surface water demonstrate a ten year trend that is below the SDWA limit of 30 µg/L (27pCi/L), with the exception of SWSD010 in April 2004. That single anomalously elevated sample was attributed to greater turbidity.

5.5.2 Sediment

Concentrations of radium-226, radium-228, thorium-230, thorium-232, and total uranium in shallow sediment were less than the USDOE surface soil guidelines and were generally indistinguishable from onsite background conditions. At all on-site sampled locations, results were less than the USDOE guideline for mixtures of radionuclides (using the sum-of-the-ratios method). Figure 2 (Appendix A, pg. F-2) shows those locations sampled for sediment. Measured results are presented (Appendix A, Table 6, pg T-13), and discussed below:

- The 2007 analytical results for Radium-226 in sediment are consistent with historical analytical results. Radium-226 results from onsite background locations SWSD009 and SWSD021 were 0.878 and 0.809 pCi/g, respectively, comparing favorably with the

historical on-site background range (from 1997 to present) of non-detect to 2.0 pCi/g. The 2007 results of analysis for Radium-226 in samples collected at on-site locations (SWSD010, SWSD011, and SWSD022) ranged from 0.856 to 1.63 pCi/g. Historically, the concentration of Radium-226 has ranged from non-detect to 3.40 pCi/g.Combined Radium-226 and Radium-228 concentrations in sediment were less than the USDOE guideline limit for residual radioactivity in surface soil criterion of 5 pCi/g above background. The combined Ra-226 and Ra-228 background in surface soil from the NFSS Remedial Investigation Report (December, 2007) is 2.18 pCi/g. Therefore, the USDOE limit for residual radioactivity in surface soil is interpreted as 7.18 pCi/g. In addition, the historic concentrations of total radium (Radium-226 and Radium-228) in sediment from 1997 to 2007 were below this criterion as shown in Figure 19.

- The 2007 analytical results for Radium-228 in sediment are consistent with historical analytical results. Radium-228 results from on-site background locations SWSD009 and SWSD021 were 0.788 and 1.20 pCi/g, respectively. The 2007 results for Radium-228 in samples collected at on-site (SWSD010, SWSD011, and SWSD022) ranged from 0.94 to 1.33 pCi/g. Historically (from 1997 to present), the on-site background concentration of radium-228 has ranged from non-detect to 2.5 pCi/g from both on-site background locations. Combined Radium-226 and Radium-228 concentrations in sediment were less than the USDOE guideline limit for residual radioactivity in surface soil criterion of 5 pCi/g above background (or 7.18 pCi/g as discussed above). In addition, the historic concentrations of total radium (Radium-226 and Radium-228) in sediment from 1997 to 2007 were below this criterion as shown in Figure 19.

- The 2007 analytical results for thorium-230 in sediment are consistent with historical analytical results. Thorium-230 results from on-site background locations SWSD009 and SWSD021 were 1.29 and 0.736 pCi/g, respectively. The 2007 results for thorium-230 in samples collected at on-site locations (SWSD010, SWSD011, and SWSD022) ranged from 1.00 to 2.50 pCi/g. Historically (from 1997 to present) the on-site background concentration of thorium-230 has ranged from 0.1 to 3.34 pCi/g. All thorium-230 concentrations in sediment were less than the USDOE surface soil criterion of 5 pCi/g above on-site background. In addition, the historic concentrations of total thorium (thorium-230 and thorium-232) in sediment from 1997 to 2007 were below this criterion as shown in Figure 20.

- The 2007 analytical results for thorium-232 in sediment are consistent with historical analytical results. Thorium-232 results from on-site background locations SWSD009 and SWSD021 were 1.29 and 1.07 pCi/g, respectively. The 2007 results for thorium-232 in samples collected at onsite locations (SWSD010, SWSD011, and SWSD022) ranged from 1.01 to 1.50 pCi/g. Historically (from 1997 to present), the on-site background concentration of thorium-232 has ranged from non-detect to 1.78 pCi/g. All thorium-232 concentrations in sediment were less than the USDOE surface soil cleanup criterion of 5 pCi/g above on-site background. In addition, the historic

concentrations of total thorium (thorium-230 and thorium-232) in sediment from 1997 to 2007 were below this criterion as shown in Figure 21.

- The 2007 analytical results for total uranium in sediment are consistent with historical analytical results. Total uranium results from on-site background locations SWSD009 and SWSD021 were 3.75 and 2.04 pCi/g, respectively. The 2007 results for total uranium in samples collected at on-site locations (SWSD010, SWSD011, and SWSD022) ranged from 2.13 to 3.15 pCi/g. Historically (from 1997 to present) the on-site background concentration of total uranium has ranged from 1.8 to 10.10 pCi/g from both on-site background locations or 1.8 to 5.97 pCi/g from sediment location SWSD009, which is considered to be more representative of background. All uranium concentrations in sediment were less that the USDOE derived surface soil cleanup criterion of 90 pCi/g above on-site background. In addition, the historic concentrations of total uranium (uranium-234, uranium-235 and uranium-238) in sediment from 1997 to 2007 were below this criterion as shown in Figure 22.

5.6 Groundwater

The locations of environmental surveillance groundwater monitoring wells at NFSS are shown in Figure 2. On-site background information, descriptions of activities performed under the groundwater surveillance program, and surveillance results are discussed below.

5.6.1 Groundwater Flow System

5.6.1.1 Natural System

Four unconsolidated geologic units and one bedrock unit are identified in the subsurface at the site. The principle hydrostratigraphic zones include the following, from top to bottom: the Upper Water Bearing Zone (fill, sand lenses, and Upper Brown Clay Till Unit), the aquitard or confining unit (Glacio-Lacustrine Clay and Middle Silt Till Units), and the Lower Water Bearing Zone (Alluvial Sand and Gravel, Basal Red Till, and Upper Queenston Formation). *See Figure-7: Schematic of Conceptualized Hydrostratigraphy in Appendix A, page F-7.* Groundwater at the NFSS primarily flows in two deposits: the upper water bearing zone in the surficial brown clay till unit and the lower water bearing zone in the combined sand and gravel unit, red till unit, and weathered portion of the Queenston Shale bedrock. As stated in Section 3.0, the glacio-lacustrine clay aquitard that hydraulically separates the upper and lower water-bearing zones will mitigate transport into the lower zone. Regional groundwater flow in both the upper and lower groundwater systems is to the northwest towards Lake Ontario.

Surface drainage from the site originally entered Fourmile, Sixmile, and Twelvemile Creeks, which all flow northward to Lake Ontario. However during the 1940s, drainage modifications routed surface water to a series of ditches that eventually coalesce into the

central drainage ditch north of the site. These ditches have variable depths that seasonally influence groundwater flow in the upper water-bearing zone on the site. The current discharge from the central drainage ditch is routed to Fourmile Creek.

5.6.1.2 Water Level Measurements

Groundwater levels were measured in ninety-one (91) NFSS wells with an electronic depth-to-water meter. Potentiometric data were recorded from forty-nine (49) wells in the upper ground water system and forty-two (42) wells in the lower groundwater system (including 6 bedrock wells).

Figures 3 through 6 in Appendix A show the piezometric surfaces and groundwater flow directions in the upper and lower units during seasonally high and low groundwater conditions. Groundwater contours initially are hand-drawn to account for site features (e.g., the IWCS and drainage ditches) and then digitized using ArcGIS® to present the groundwater flow directions and gradients in report-quality graphics.

The screened intervals for wells completed in the upper groundwater zone range from 1.4 to 8.4 m (4.7 to 27.6 ft) below ground surface, while screened intervals for wells completed in the lower groundwater zone range from 6.8 to 31.9 m (22.4 to 104.5 ft) below ground surface. The ninety-one groundwater monitoring wells are located throughout the NFSS and provide significant areal coverage for groundwater flow characterization. The monitored (sampled) subset of eight (8) wells provide adequate data to assess the IWCS performance and monitor specific areas of concern in the upper water-bearing zone (Appendix A, Figure 2).

In the upper water-bearing zone, the depth to water ranged from 0.11 to 6.07 m (0.36 to 19.93 ft) below ground surface during 2007. The quarterly water level fluctuations in the upper water-bearing zone averaged 0.78 m (2.55 ft) and showed high and low elevations during the February and October measurements, respectively. In the lower groundwater system, the depth to water ranged from 0.29 to 3.76 m (0.94 to 12.35 ft) below ground surface during 2007. Quarterly water-level fluctuations in the lower groundwater system averaged 0.38 m (1.26 ft) and showed high and low elevations during May and October measurements respectively.

Groundwater elevations measured quarterly during 2007 in the upper water-bearing zone show a high condition occurred on February 20, 2007 and a low condition on October 16, 2007. The high-water elevations in the upper system ranged from 90.63 to 97.20 m (297.34 to 318.89 ft) above mean sea level, whereas the low-water condition ranged from 90.50 to 96.64 m (296.92 to 317.05 ft). Groundwater elevations in the lower water bearing zone indicate a seasonal high occurred on May 15, 2007 and a seasonal low occurred on October 16, 2007. The high-water elevation in the lower system ranged from 95.23 to 96.97 m (312.44 to 318.12 ft) above mean sea level, whereas the low-water condition ranged from

92.71 to 96.01 m (304.15 to 314.98 ft). See Figures 3 through 6 in Appendix A for a graphical representation of these data, interpreted groundwater flow directions, and conditions evident from local clay mining west of the NFSS.

Head fluctuations in both the upper and lower water-bearing zones were greater in 2007 than 2006 due to the dry summer months, which increased summer-season soil-moisture stresses on the upper zone groundwater. Precipitation data recorded at the Niagara Falls International Airport indicate that May 2007 through October 2007 precipitation was only 60% the norm for this period. Similar trends are likely for the NFSS, as evident in the water level data. Two wells (215A and 810A) were dry in August, whereas 6 wells (OW08B, OW11B, OW12B, 215A, 505 and 810A) were dry in October, 2007.

Water-level data indicate that the upper water-bearing zone responds more rapidly to the recharge and discharge seasons (wet and dry periods) than the lower confined groundwater system due to the intervening Glacio-Lacustrine Clay and Middle Silt Till Units (as a regional aquitard). The two water-bearing zones demonstrate hydraulic separation through independent water-level responses, as exemplified by the temporally different seasonal high and low conditions. The high-stress (dry) summer conditions produced low water levels in 2007; October low levels in the LWBZ were due to lower recharge regionally. The normal two- to three-month time lag between head extremes likely indicate that the aquitard governs vertical flow at the NFSS, even where thin (e.g., a 2.5-foot thickness at wells OW10A and OW10B still produces up to 0.6 m (2 ft) of head differential between the wells).

Vertical gradients derived from heads in monitoring well pairs vary with seasonality. Flow from the upper zone to the lower zone was dominant during the first and second quarterly measurements. However, during the third and fourth quarters, the majority of elevations in the lower system were greater than those measured in the upper system, albeit very slight in some cases. This seasonal variation in the direction and magnitude of vertical gradients will affect vertical flow between water bearing zones and potentially long-term transport of contaminants between water bearing zones, thereby maintaining the upper zone as the primary transport pathway at the NFSS. While groundwater flow is primarily horizontal in these upper and lower zones, the upward vertical gradients help impede the potential for downward migration of contaminants into the lower zone from possible contaminant sources in the upper zone.

5.6.1.3 Groundwater Flow

Water-bearing hydrostratigraphic zones in the layered glacial sediments underlying the NFSS include the upper surficial clay till unit, the lower alluvial sand and gravel, and the weathered bedrock unit (i.e., approximated as the upper 10 feet of bedrock). Groundwater-level data indicate that the intervening glaciolacustrine clay unit hydraulically separates the upper clay till unit from the lower sand and gravel unit; this glaciolacustrine clay is present

across the entire site. The average horizontal gradients in the upper system range between 0.0007 and 0.024 ft/ft and are dependent on regional to local flow conditions (i.e., flow across the site versus along the IWCS to the central drainage).

Local groundwater flow in the upper water-bearing zone to the central drainage ditch (CDD) is a prevalent condition during the year, whereas other tributary ditches appear to have a lesser influence on site-wide groundwater flow. The northwesterly regional flow gradient across the site are presented to illustrate the potential for long-term (and larger scale) flow and transport directions from the site.

Localized on-site flow towards the central drainage ditch east of the IWCS is consistently apparent due to the unique flow boundary conditions in this area (i.e., IWCS cut-off wall, low recharge due to a sloped [well drained] land surface, and proximate ditch). Other site ditches show various degrees of influence on groundwater levels, which are accounted for on the potentiometric map, where data allow. The drainage ditches at the NFSS have accumulated sediment and organic matter since their original installation (up to 10-feet deep); consequently they do not fully penetrate the upper water-bearing zone and some groundwater is assumed to pass beneath the ditches during high-water periods. Water-level contours may be drawn through the ditches to reflect some groundwater flow beneath them. During the summer, vegetation within the ditches will evapotranspire groundwater and promote lower local heads near site ditches.

The lower groundwater system generally shows a northerly to northwesterly flow under gradients of 0.001 to 0.004 ft/ft. This flow vector has been affected by the excavation of a clay borrow operation west of the site (mining the Glaciolacustrine Clay), where local surface-water recharges the lower water-bearing zone in the spring, which has caused the normally northwestern gradients to have a northerly component during the high-water period (May 2007). The local groundwater low underlying the IWCS is likely a combined artifact of impressed heads to the west, variations in the thickness of the gray clay aquitard and underlying hydrostratigraphic layers, and topography of the Queenston Shale. The October potentiometry in Figure 5 shows an alleviation of the impressed heads to the west and a return to normal flow westerly directions, which may be due to lower rainfall and evaporative losses at the nearby clay pit.

A groundwater flow velocity of 38 cm/y (15 in/y) was estimated at NFSS in 1994 (USDOE 1994b). More recent RI modeling estimated an average flow velocity of 28 cm/y (11 in/yr) in off-site areas; this values is based upon the regional gradients and variable hydraulic conductivities presented in USACE (2007). Such velocity values will vary based on local conditions (i.e., the spatial scale of hydraulic conductivity and gradient estimations used). These velocity values do not represent a contaminant migration rates since contaminant-soil partitioning retards (or slows) the rate of contaminant flow (transport) with respect to groundwater flow. This partitioning causes contaminants to adsorb, or bind, to local fine-grained soils in the upper water-bearing zone and aquitard sediments.

5.6.2 Groundwater Analytical Results

5.6.2.1 Field Parameters

Table 7, Appendix A summarizes field measurements (temperature, pH, specific conductance, oxidation-reduction potential, and turbidity) for 2007 environmental surveillance sampling. These measurements represent water conditions at the time of sampling.

5.6.2.2 Water Quality Parameters

At NFSS, water quality in the upper water-bearing zone is indicative of low recharge to a hydraulically slow flow system, which produces poor-quality (near-saline) groundwater containing high total dissolved solids and calcium/magnesium sulfates. Water quality in the lower water-bearing zone is poor due to high total dissolved solids produced by long residence times associated with long (possibly tortuous) flow paths from aerial recharge zones. It is likely that the lower groundwater system receives recharge along the base of the Niagara Escarpment, situated approximately 3.2 km south of the site (USDOE 1994b) and, to a lesser extent, via downward flow from the upper unit during spring recharge. Water quality parameter data for 2007 are provided in Table 8, Appendix A.

Analytical results for sodium and sulfate were consistently above the drinking water standards in both the up gradient (background) and down gradient samples. These values indicate that groundwater in the area is naturally saline and confirm the findings of regional to local studies that state groundwater quality is poor near the site because of high mineralization (La Sala 1968; Wehran 1977; Acres American 1981). Groundwater at NFSS is not used as a public water supply, although the comparison to the drinking water standard will continue to be used to provide a conservative evaluation of groundwater analytical results.

For comparative purposes, the NYSDEC Class GA water quality standards shall be utilized when primary Federal standards are not available. Sodium was detected in all wells, including the background well, at concentrations ranging from 44.4 mg/L to 75.3 mg/L, which are consistently greater than the NYSDEC Class GA groundwater quality standard of 20 mg/L for sodium. Sulfate was detected in all wells at concentrations ranging from 342.0 mg/L to 1090.0 mg/L, which are greater than the NYSDEC Class GA groundwater quality standard for sulfate of 250 mg/L. Fluoride was detected in all wells at concentrations ranging from 0.12 mg/L to 0.57 mg/L, which are less than the NYSDEC Class GA groundwater quality standard of 1.5 mg/L for fluoride.

5.6.2.3 Groundwater - Radioactive Constituents

In 2007, unfiltered groundwater samples collected from seven groundwater monitoring wells completed in the upper water-bearing zone were analyzed for radium-226, radium-228, thorium-230, thorium-232, uranium-234, uranium-235, and uranium-238. Environmental surveillance analytical results for radioactive constituents in groundwater are presented in Appendix A, Table 9 and Figures 23 through 26. Only results for detected analytes are discussed and used in constituent average values.

Combined concentrations of radium-226 and radium-228 at NFSS are below the SDWA MCL of 5 pCi/L. Thorium-230 and thorium-232 concentrations are below USDOE DCGs (100 pCi/L and 50 pCi/L, respectively) and the SDWA MCL of 15 pCi/L, adjusted gross alpha MCL, for combined thorium-230 and thorium-232 in drinking water. The 2007 total uranium analytical results are consistent with the historical results. Total uranium concentrations are below the SDWA MCL 30 µg/L or 27 pCi/L, with the exception of OW04B and A45. Since 1992, total uranium concentrations in all sampled wells have been less than 60 pCi/L (background not subtracted), which falls below the USDOE DCG of 600 pCi/L for water.

All analytical results for radium-226, radium-228, thorium-230, thorium-232, and total uranium in groundwater were well below the USDOE DCGs. At all sampled locations, results were less than the USDOE guideline for mixtures of radionuclides (using the sum-of-the-ratios method). Current analytical results (background not subtracted) are summarized below.

Note: Groundwater at NFSS is not a drinking water source. Samples from all seven wells have unfiltered results for comparison purposes.

- The 2007 total (unfiltered) analytical results for radium-226 ranged from non-detect to 0.636 pCi/L. The USDOE DCG for radium-226 is 100 pCi/L above background and the SDWA MCL for combined radium-226 and radium-228 is 5 pCi/L (2007 background level was non-detect). Total radium (Ra-226 and Ra-228) concentrations in groundwater are below the SDWA limit of 5 pCi/L and the USDOE DCG of 100 pCi/L, as shown in Figure 23 from 1997 to 2007.

- The 2007 total (unfiltered) analytical results for radium-228 were all non-detect. The USDOE DCG for radium-228 is 100 pCi/L above background and the SDWA MCL for combined radium-226 and radium-228 is 5 pCi/L (2007 background levels was non-detect). Total radium (Ra-226 and Ra-228) concentrations in groundwater are below the SDWA limit (5 pCi/L) and the USDOE DCG (100 pCi/L), as shown in Figure 23 from 1997 to 2007.

- The 2007 total (unfiltered) analytical results for thorium-230 ranged from non-detect to

0.672 pCi/L. The USDOE DCG for thorium-230 is 300 pCi/L above background and the SDWA MCL for thorium-230 and thorium-232 is 15 pCi/L, adjusted gross alpha MCL (2007 background levels was non-detect). Thorium-230 concentrations in groundwater are below the SDWA limit of 15 pCi/L and the USDOE DCG of 300 pCi/L, as shown in Figure 24 from 1997 to 2007.

- The 2007 total (unfiltered) analytical results for thorium-232 are non-detect. The USDOE DCG for thorium-232 is 50 pCi/L above background and the SDWA MCL for thorium-230 and thorium-232 is 15 pCi/L, adjusted gross alpha MCL, (2007 background level for thorium -232 was non-detect). Thorium-232 concentrations in groundwater are below the SDWA limit of 15 pCi/L and the USDOE DCG of 50 pCi/L, as shown in Figure 25 from 1997 to 2007.

- The 2007 total (unfiltered) analytical results for total uranium ranged from 4.49 to 35.78 pCi/L The USDOE DCG for total uranium is 600 pCi/L above background (2007 background level was 7.32 pCi/L). The USEPA National Primary Drinking Water Regulation for Radionuclides (Final Rule – effective 2003) states the SDWA MCL for total uranium is 30 µg/L or 27 pCi/L. Two wells exceeded this limit for unfiltered groundwater samples, OW04B at 35.78 pCi/L, or 39.75 µg/L, and A45 at 30.46 pCi/L, or 33.84 µg/L. Total uranium concentrations in groundwater are below the USDOE DCG of 600 pCi/L, as shown in Figure 26. Historic total uranium concentrations in groundwater, as shown in Figure 26, are also below the SDWA limit of 27 pCi/L, with the exception of well A45 between 2001 to 2003, 2006 and 2007, well OW04B between 2001 and 2007. However, total uranium concentrations in groundwater in wells A45 and OW04B do not exhibit consistently increasing trends throughout the ten year period. *Note: The total uranium MCL of 30 µg/L is for comparative purposes only and includes background*

5.6.2.4 Groundwater - Chemical Constituents/Metals

The 2007 environmental surveillance analytical results for metals in groundwater are presented in Table 10, Appendix A, and discussed below.

Groundwater at NFSS is not used as a public drinking water supply, although sampling results are compared to the SDWA MCLs and New York State Water Quality Regulation Class GA standards as a conservative baseline. Copper was present in eight and lead in two groundwater monitoring wells sampled at NFSS, although the 2007 analytical results indicate that neither the SDWA MCLs nor the New York State Water Quality Regulation Class GA standards for these metals were exceeded at any well. Vanadium was not detected in the eight wells sampled in 2007.

5.6.2.5 Groundwater - Chemical Constituents/Metals

The 2007 environmental surveillance analytical results for metals in groundwater are presented in Table 10, Appendix A, and discussed below.

Groundwater at NFSS is not used as a public drinking water supply, although sampling results are compared to the SDWA MCLs and New York State Water Quality Regulation Class GA standards as a conservative baseline. Copper was present in eight and lead in two groundwater- monitoring wells sampled at NFSS, although the 2007 analytical results indicate that neither the SDWA MCLs nor the New York State Water Quality Regulation Class GA standards for these metals were exceeded at any well. Vanadium was not detected in the eight wells sampled in 2007.

- Copper 2007 total (unfiltered) analytical results ranged from 1.8 µg/L to 9.0 µg/L. The SDWA action level is 1,300 µg/L and the New York State Water Quality Regulation Class GA standard is 200 µg/L. Historically the concentration of copper has ranged from non-detect to 62.4 µg/L.

- Lead 2007 total (unfiltered) analytical results ranged from non-detect to 3.20 µg/L. The SDWA action level is 15 µg/L and the New York State Water Quality Regulation Class GA standard is 25 µg/L. Historically the concentration of lead has ranged from non-detect to 6.8 µg/L.

- Vanadium 2007 total (unfiltered) analytical results were non-detect (less than 16.0 µg/L). Historically the concentration of vanadium has ranged from non-detect to 53.4 µg/L. Neither an SDWA MCL nor a New York State Water Quality Regulation Class GA standard has been established for vanadium.

6.0 CONCLUSIONS

6.1 External Gamma Radiation

For 2007 the calculated hypothetical doses from external gamma radiation are 0.006 mrem for the nearest resident and 0.002 mrem for the nearest off-site worker.

6.2 Radon Gas

Results of the 2007 radon gas surveillance program indicate radon gas emissions are comparable to background. The radon gas concentrations at the site were consistently low (non-detect to 0.7 pCi/L, including background (Appendix A, Table 3)). All radon gas concentration analytical results at NFSS were well below the USDOE limit for radon-222 of 3.0 pCi/L above background (Appendix A, Table 3).

6.3 Radon-222 Flux

The 2007 radon-222 flux measurements were indistinguishable from background. Results ranged from non-detect to 0.06571 $pCi/m^2/s$, with an average (of detects and non-detects) result of 0.02974 $pCi/m^2/s$ (Appendix A, Table 4). The average value is less than one percent of the standard of 20 $pCi/m^2/s$ specified in 40 CFR Part 61, Subpart Q of the National Emission Standards for Hazardous Air Pollutants (NESHAPs), demonstrating the effectiveness of the containment cell design and construction in mitigating radon-222 migration.

6.4 Airborne Particulate Dose

The 2007 airborne particulate annual dose from the wind erosion of soil to a hypothetical maximally exposed individual is calculated at 0.00084 mrem (Appendix C, FUSRAP CY2007 NESHAP ANNUAL REPORT FOR NIAGARA FALLS STORAGE SITE (NFSS), section 4.3). The hypothetical annual dose to the individual can be compared to the 10 mrem/year dose standard in 40 CFR Part 61, Subpart H of NESHAPs. The 2007 hypothetical airborne particulate annual collective dose to the population within an 80 km radius of the site is calculated at 0.026 person-rem (Appendix C, FUSRAP CY2007 NESHAP ANNUAL REPORT FOR NIAGARA FALLS STORAGE SITE (NFSS), section 5.1).

6.5 Cumulative Dose from External Gamma Radiation and Airborne Particulates

The CY 2007 maximum annual total external gamma radiation and airborne particulate dose to a hypothetical individual is 0.007 mrem [0.006 + 0.00084 (assumes same individual receives both maximum doses from external and airborne dose pathways)], Appendix B, CY2007 CALCULATION OF EXTERNAL GAMMA RADIATION DOSE RATES FOR

NIAGARA FALLS STORAGE SITE (NFSS), Section 4.2 and Appendix C, FUSRAP CY2007 NESHAP ANNUAL REPORT FOR NIAGARA FALLS STORAGE SITE (NFSS), Section 4.3, respectively. This value can be compared to the USDOE limit of 100 mrem/year and the US average per capita background dose of approximately 360 mrem/year.

6.6 Surface Water

In 2007, onsite radionuclide concentrations in surface water samples were consistent with historical results that indicate no evidence of a release.

6.7 Sediment

In 2007, onsite radionuclide concentrations in sediment samples were consistent with historical results that are comparable to background and indicate no evidence of a release.

6.8 Groundwater

Current and past onsite radionuclide concentrations in groundwater samples from the upper water bearing zone indicate total uranium levels in excess of background and in some wells the SDWA MCL. The uranium levels are indicative of uranium groundwater contamination caused by past radioactive waste storage practices identified during the remedial investigation and are limited in extent, i.e., generally coincident with historical use areas. Uranium levels in groundwater will continue to be monitored as part of the environmental surveillance program and the on-going CERCLA process will evaluate the extent of uranium in groundwater in excess of background levels and applicable regulatory limits throughout NFSS.

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APPENDIX A

NFSS 2007 ENVIRONMENTAL SUREVELLANCE TECHNICAL MEMORANDUM TABLES AND FIGURES

Environmental Monitoring at NFSS

This appendix documents the results of environmental monitoring activities conducted in 2007 and supplements the environmental surveillance information included in the body of this technical memorandum. These activities are described to present a more complete picture of the site activities during the year and to provide technical reviewers with sufficient information to determine how much these activities influenced site conditions and ultimately the environmental surveillance program.

Two distinct activities compose the FUSRAP monitoring program at NFSS: environmental monitoring and environmental surveillance. Environmental monitoring consists of measuring the quantities and concentrations of pollutants in solid wastes, liquid effluents, and air that are discharged directly to the environment from onsite activities. Environmental surveillance documents the effects, if any, of USACE activities on onsite and offsite environmental and natural resources. At FUSRAP sites, because there are typically no onsite waste treatment facilities with routine point discharges, the monitoring program consists primarily of environmental surveillance (USACE 2000*)*. The Environmental Surveillance Technical Memorandum specifically reports the results of routine environmental surveillance sampling and, at applicable sites, includes information about routine environmental monitoring (storm water discharges and radon flux measurement).

From November 1999 to October 2003, surface water, sediment, soil, groundwater, and other media was sampled to support a three-phased Remedial Investigation (RI) at NFSS.

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FUSRAP NIAGARA FALLS STORAGE SITE

2007

TABLES

ENVIRONMENTAL SURVEILLANCE TECHNICAL MEMORANDUM

US Army Corps
of Engineers ®
Buffalo District

Table A.1

(Section 1.2 Unit Conversions)
Units of Measurement and Conversion Factors – Dose and Radioactivity

Parameter	Conventional Units	SI Units	Conversion Factor
Dose	millirem (mrem)	milliSievert (mSv)	1 mrem = 0.01 mSv
Activity	picoCurie (pCi)	becquerel (Bq)	1 pCi = 0.037 Bq

Table A.2

Units of Measurement and Conversion Factors - Mass, Length, Area, and Volume

Parameter	SI Units	English Units	Conversion Factor
Mass	gram (g)	Ounce (oz)	1 g = 0.035 oz
	Kilogram (kg)	Pound (lb)	1 kg = 2.2046 lb
Length	centimeter (cm)	Inch (in.)	1 cm = 0.394 in.
	meter (m)	foot (ft)	1 m = 3.281 ft
	kilometer (km)	mile (mi.)	1 km = 0.621 mi.
Area	hectare (ha)	Acre	1 ha = 2.47 acres
Volume	Milliliter (mL)	Fluid ounce (fl. oz.)	1 mL = 0.0338 fl. oz.
	liter (L)	gallon (gal)	1 L = 0.264 gal
	cubic meter (m^3)	Cubic yard (yd^3)	1 m^3 = 1.307 yd^3

Table B

(Section: 2.1 External Gamma Radiations and Air (Radon Gas and Airborne Particulates))
Summary of Radiological Standards and Guidelines for External Gamma Radiation and Air

Parameter	USDOE Order 5400.5 [a]	Other Federal Standard or Guidelines
Radon-222 flux	20 pCi/m^2/s	20 pCi/m^2/s [b]
Radon-222	3.0 pCi/L [e]	-
Radionuclide emissions (airborne particulates and radioactive gases excluding radon-220 and radon-222)	10 mrem/y	10 mrem/y [b]
Effective dose equivalent (total contribution from all sources[c])	100 mrem/y	100 mrem/y [d]

a. *Guidelines provided in the USDOE Order are above background concentrations or exposure rates.*
b. *Federal (USEPA) Standard from 40 CFR, Part 61, subparts H (radionuclide emissions) and Q (radon-222 flux).*
c. *Contributing sources at NFSS consist of external gamma radiation exposure, radionuclide emissions listed above, and ingested radionuclides in water and soil/sediment (listed in the following table).*
d. *Federal (USNRC) Standard 10 CFR 20*
e. *The guideline of 3.0 pCi/L is based on an annual average value at or above any location outside of the facility site.*

Table C
(Section: 2.2.2 Safe Drinking Water Act (SDWA))

Summary of Radiological Standards and Guidelines for Water and Sediment

Parameter	USDOE DCG [a] for Water [b]	Other Federal Standards	USDOE Guideline Limit for Residual Radioactivity in Surface Soil [c,d]
Total uranium	600 pCi/L	30 µg/L [e]	90 pCi/g
Thorium-232	50 pCi/L	15 pCi/L [f]	5 pCi/g
Thorium-230	300 pCi/L	15 pCi/L [f]	5 pCi/g
Combined Radium-226&228	100 pCi/L	5 pCi/L [e]	5 pCi/g

a. *USDOE derived concentration guide USDOE Order 5400.5) for drinking water. Groundwater at NFSS is not a drinking water source. The above concentration is for comparative purposes only.*

b. *Surface water and groundwater (non-drinking water values); criteria represent concentrations above background. If a mixture of radionuclides is present, the sum of the ratios of each isotope to its respective DCG must be less than one.*

c. *Above-background concentrations in* soil, *averaged over the topmost 15-cm of soil.*

d. *There are no standards for sediment; therefore, the USDOE residual (radium and thorium) and site-specific (uranium) surface soil cleanup guideline criteria are used as a basis for evaluating analytical results for sediment. If a mixture of the radionuclides is present in soil, then the sum of the ratios of the concentration of each isotope to the allowable limit must be less than one. This guideline applies for total uranium in natural isotopic abundance.*

e. *This regulation* for *uranium of 30 µg/L became effective December 8, 2003 –National Primary Drinking Water Regulations; Radionuclides; Final Rule (Federal Register- December 7, 2000. Current SDWA MCL for the combined concentration of radium-226 and radium-228 in drinking water is 5pCi/L (40CFR141.1) Groundwater at NFSS is not a drinking water source. The above concentration is for comparative purposes only.*

f. *"Adjusted" gross alpha MCL of 15 pCi/L, including Thorium isotopes, excluding radon and uranium –National Primary Drinking Water Regulations; Radionuclide; Final Rule (Federal Register- December 7,2000)*

Table D

(Section: 2.3 Groundwater - Chemical Parameters)

Groundwater - Chemical Parameters

Analyte	Related Regulations[a] Federal (mg/L)	State[c] (mg/L)
Alkalinity, Total as $CaCO_3$	NE	NE
Bicarbonate (HCO_3)	NE	NE
Calcium (Ca)	NE	NE
Carbonate (CO_3)	NE	NE
Chloride	250[d]	250
Copper	1.3[e]	0.2[e]
Fluoride	4	1.5
Lead	0.015[e]	0.025[e]
Magnesium (Mg)	NE	NE
Nitrogen, Nitrate	10[b]	10
Nitrogen, Nitrite	1[b]	1
Phosphorous, Total	NE	NE
Potassium (K)	NE	NE
Sodium (Na)	NE	20
Sulfate (SO_4)	250[d]	250
Vanadium	NE	NE

a. **Regulations presented pertain to drinking water quality and are listed for comparison only. No drinking water supply is obtained from groundwater at NFSS.** NE - Not established.

b. Federal Safe Drinking Water Act maximum contaminant levels from USEPA Drinking Water Regulations (40CFR141.62)

c. Water Quality Criteria (class GA) per 6 NYCRR, Part 703.

d. National Secondary Drinking Water Regulations (40CFR143.3). These regulations primarily control and affect the aesthetic qualities of drinking water

e. Action Level

Table E

(Section: 4.0 SURVEILLANCE METHODOLOGIES)

FUSRAP Instruction Guides Used for Environmental Surveillance Activities

Document Number	Document Title
191-IG-007	Groundwater Level and Meteorological Measurements (BNI 1996b)
191-IG-011	Decontamination of Field Sampling Equipment at FUSRAP Sites (BNI 1996c)
191-IG-028	Surface Water and Sediment Sampling Activities (BNI 1993a)
191-IG-029	Radon/Thoron and TETLD Exchange (BNI 1993b)
EPA/540/S-95/504	EPA Ground Water Issue Low-Flow(Minimal Drawdown) Ground-Water Sampling Procedures.

Table 1a
Environmental Surveillance Summary
External Radiation, Radon Gas and Radon-222 Flux
Niagara Falls Storage Site

TABLE 1a		Number of Analyses or Measurements																
		No. of Sample Locations				Sample Duplicate				Ship Blank				Contingency Sample				Total Analyses per Year
Measured Parameter	Station Identification	CY Quarter				CY Quarter				CY Quarter				CY Quarter				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
LABORATORY MEASUREMENTS																		
External gamma radiation (TLDs)[a]	1, 7, 8, 10, 11, 12, 13, 15 18, 21, 23, 24, 28, 29, 36	20		20		1		1		1		1		20		20		84
Radon gas	105, 116, 120 122, 123	20		20		1		1										42
Radon-222 flux	Waste Containment Structure			183														183

a. TLD = Thermo Luminescent Dosimeter

Table 1b
Environmental Surveillance Summary
Groundwater
Niagara Falls Storage Site

Measured Parameter	Station Identification	Number of Analyses or Measurements																								Total Analyses per Year
		No. of Sample Locations				Rinsate Blank				Trip Blank				Sample Duplicate				Matrix Spike				Matrix Spike Duplicate				
		CY Quarter				CY Quarter				CY Quarter				CY Quarter				CY Quarter				CY Quarter				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
FIELD MEASUREMENTS																										
Dissolved oxygen	A45, A50, OW04B, OW06B, OW13B, OW15B, OW17B, B02W20S		8																							8
ORP[a]			8																							8
Turbidity			8																							8
Temperature			8																							8
Specific conductivity			8																							8
pH			8																							8
LABORATORY MEASUREMENTS																										
Radiological	A45, A50, OW04B, OW06B, OW13B, OW15B, OW17B, B02W20S																									
Uranium-234/235/238			8				1								1				1							11
Radium-226/228			8				1								1				1							11
Thorium-230/232			8				1								1				1							11
Metals																										
Copper			8				1								1				1							11
Lead			8				1								1				1							11
Vanadium			8				1								1				1							11
Water Quality[b]			8				1								1				1							11

a. ORP = Oxidation-Reduction Potential
b. Table 8 lists water quality parameters.

Table 1c
Environmental Surveillance Summary
Surface Water and Sediment
Niagara Falls Storage Site

Measured Parameter	Station Identification	Number of Analyses or Measurements																								Total Analyses per Year
		No. of Sample Locations				Rinsate Blank				Trip Blank				Sample Duplicate				Matrix Spike				Matrix Spike Duplicate				
		CY Quarter				CY Quarter				CY Quarter				CY Quarter				CY Quarter				CY Quarter				
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
FIELD MEASUREMENTS																										
Chemical																										
Dissolved oxygen	SWSD009		5																							5
Eh	SWSD010		5																							5
Turbidity	SWSD011		5																							5
Temperature	SWSD021		5																							5
Specific conductivity	SWSD022		5																							5
pH			5																							5
LABORATORY MEASUREMENTS																										
Radiological																										
Surface Water																										
Uranium-234/235/238	SWSD009		5												1				1							7
Radium-226/228	SWSD010		5												1				1							7
Thorium-230/232	SWSD011		5												1				1							7
Sediment	SWSD021																									
Uranium-234/235/238	SWSD022		5				1								1				1							8
Radium-226/228			5				1								1				1							8
Thorium-230/232			5				1								1				1							8

Table 2
2007 External Gamma Radiation Dose Rates
Niagara Falls Storage Site

Monitoring Location	Monitoring Station	Gross TLD Data[a] (mrem) (First period)	Gross TLD Data[a] (mrem) (Second period)	Normalized Gross TLD Data[b] (mrem/yr)	CY2007 Net TLD Data[c] (mrem/yr)
NFSS Perimeter	1	21.8	23.7	48.4	14.0
	1	15.3	21.8	39.5	5.1
	7	12.8	25.1	40.3	5.9
	7	20.0	20.8	43.4	9.0
	11	16.4	21.3	40.1	5.7
	11	17.4	20.0	39.8	5.4
	12	14.4[d]	19.9	36.5	2.1
	12	14.4[d]	17.1	33.5	-0.9
	13	-0.1	21.4	22.7	-11.7
	13	-4.1	18.8	15.6	-18.8
	15	21.2	24.4	48.5	14.1
	15	17.8	24.4[e]	44.9	10.5
	28	12.3	24.3	38.9	4.5
	28	10.0	24.4	36.6	2.2
	29	13.7	25.0	41.2	6.8
	29	9.7	25.0[e]	36.9	2.5
	36	20.0	21.7	44.4	10.0
	36	21.0	20.3	43.9	9.5
	122	10.5	20.7	33.2	-1.2
	122	18.5	20.7[e]	41.7	7.3
	123	20.4	18.0	40.9	6.5
	123	14.3	18.0[e]	34.4	0.0
IWCS Perimeter	8	10.1	18.5	30.4	-4.0
	8	2.6	21.7	25.9	-8.5
	10	7.7	22.1	31.7	-2.7
	10	6.2	25.3	33.5	-0.9
	18	8.5	22.1	32.6	-1.8
	18	10.4	20.4	32.8	-1.6
	21	0.6	19.7	21.6	-12.8
	21	10.2	19.6	31.7	-2.7
	23	17.6	19.1	39.1	4.6
	23	14.0	21.6	37.9	3.5
	24	16.8	17.1	36.1	1.7
	24	10.1	20.4	32.5	-2.0
Background	105	12.6	18.9	33.5	---
	105	19.5	20.6	42.7	---
	116	4.3	18.3	24.0	---
	116	14.1	18.0	34.2	---
	120	12.7	19.8	34.6	---
	120	15.4	19.8[e]	37.5	---
Average Background		13.1	19.2	34.4	

Exposure Period 09JAN - 19JUL2007 and 19JUL - 18DEC2007

[a] All data reported from the vendor are gross results in mrem per monitoring period.

[b] Gross data for each period are normalized to a daily dose rate, averaged, and then normalized for the length of the year (365 days)

[c] Net data are corrected by subtracting the average normalized background value.

[d] TLDs missing and presumed taken by unauthorized person(s).
Location 12 values are assumed and the average of the other 1st period NFSS Perimeter values.

[e] TLD lost during analysis. Replaced with value from co-located badge.

Table 3
2007 Radon Gas Concentrations[a]

Average Daily Concentration (pCi/L)[b]

Monitoring Location[c]	Monitoring Station	Start Dates[d]:	1/9/2007	7/19/2007
		End Dates[d]:	7/19/2007	12/18/2007
NFSS	1		0.3	0.4
Perimeter[g]	7		< 0.2	0.7
	11		< 0.2	0.5
	12		< 0.2	0.6
	12 (dup[e])		< 0.2	0.5
	13		0.2	0.4
	15		< 0.2	0.5
	28		< 0.2	0.5
	29		< 0.2	0.4
	36		< 0.2	0.6
	122		< 0.2	0.6
	123		< 0.2	0.5
IWCS[f]	8		0.3	0.6
Perimeter	10		< 0.2	0.4
	18		< 0.2	0.5
	21		< 0.2	0.6
	23		< 0.2	0.6
	24		< 0.2	0.4
Background	105		< 0.2	0.5
	116		< 0.2	0.4
	120		< 0.2	0.5

a. Radon gas concentrations in 2007 were measured with RadTrak® detectors. These detectors measure the combined concentration of radon-220 and radon-222 in air.
b. pCi/L - picocuries per liter.
c. Monitoring locations are shown in Figure 2.
d. Detectors were installed and removed on the dates listed.
e. A quality control duplicate is collected at the same time and location and is analyzed by the same method for evaluating precision in sampling and analysis.
f. Monitoring locations are at the perimeter of the interim waste containment structure (IWCS).
g. Monitoring locations are at the perimeter of the site with exception of monitoring location 123.

Note: DOE off-site limit for radon-222 concentration is 3.00 pCi/L.
(<0.2) Indicates detection limit is reported. Actual result is less than this value.
1 pCi = 0.037 becquerel

Table 4
2007 Radon Flux Monitoring Results[a]
Niagara Falls Storage Site

NFSS Sample ID	Qualifier[d]	Radon-222 Flux (pCi/m^2/s)	±		MDA	NFSS Sample ID	Qualifier[d]	Radon-222 Flux (pCi/m^2/s)	±		MDA	NFSS Sample ID	Qualifier[d]	Radon-222 Flux (pCi/m^2/s)	±		MDA
1	U	0.03269	±	0.02216	0.04881	41	U	0.03153	±	0.03548	0.06343	81	U	0.05372	±	0.03901	0.08093
2	U	0.01172	±	0.03010	0.08171	42	U	0.03374	±	0.04040	0.10830	82	U	0.03464	±	0.02332	0.06359
3		0.03751	±	0.01390	0.03454	43	U	0.00911	±	0.01889	0.04562	83	U	0.08110	±	0.05537	0.13580
4	U	0.02569	±	0.04198	0.10560	44	U	0.01826	±	0.03405	0.09218	84	U	-0.00332	±	0.01946	0.04256
5	U	0.02486	±	0.01734	0.04434	45	U	0.03331	±	0.02613	0.05557	85	U	0.03242	±	0.04454	0.11990
6	U	0.03389	±	0.03974	0.10640	46	U	0.05180	±	0.04227	0.11970	86	U	0.04324	±	0.02866	0.07270
7	U	0.02900	±	0.03134	0.06079	47	U	-0.00060	±	0.01784	0.03979	87	U	-0.00358	±	0.05055	0.10950
8	U	0.04229	±	0.04295	0.11450	48	U	0.01921	±	0.02730	0.08476	88	U	0.02789	±	0.03304	0.06464
9	U	0.04285	±	0.03156	0.06662	49	U	0.05608	±	0.02911	0.07070	89	U	0.02153	±	0.04016	0.10870
10	U	0.01949	±	0.03402	0.09200	50	U	0.02780	±	0.03191	0.09552	90		0.06149	±	0.02195	0.04601
10-DUP[b]	U	0.01762	±	0.03922	0.09811	50-DUP[b]	U	0.00408	±	0.03471	0.08482	90-DUP[b]		0.06571	±	0.02114	0.04954
11	U	0.00835	±	0.01999	0.04656	51	U	0.00847	±	0.02234	0.05062	91	U	0.00480	±	0.04089	0.09990
12	U	0.00557	±	0.02074	0.04655	52	U	0.03861	±	0.02293	0.05847	92	U	0.08187	±	0.04977	0.14090
13	U	0.04753	±	0.03978	0.11310	53	U	0.08438	±	0.05323	0.14410	93	U	0.07097	±	0.03598	0.08949
14	U	0.02626	±	0.01688	0.04718	54	U	0.00622	±	0.02189	0.04919	94	U	0.01402	±	0.02669	0.08712
15	U	-0.00260	±	0.04701	0.09947	55	U	0.04269	±	0.04977	0.12580	95	U	0.04593	±	0.02946	0.07240
16	U	0.03949	±	0.02471	0.06261	56	U	0.03250	±	0.01882	0.05148	96	U	-0.01323	±	0.03159	0.06906
17	U	0.01982	±	0.03997	0.10020	57	U	-0.00462	±	0.03776	0.08410	97	U	0.01358	±	0.02352	0.05704
18	U	0.03199	±	0.02308	0.05310	58	U	0.00061	±	0.02186	0.04681	98	U	-0.01369	±	0.01806	0.02539
19	U	0.03361	±	0.04507	0.11380	59	U	0.02790	±	0.03203	0.09587	99	U	0.03696	±	0.02661	0.06614
20	U	0.01652	±	0.01924	0.04878	60	U	0.00542	±	0.01807	0.04315	100	U	0.04330	±	0.05016	0.13430
20-DUP[b]	U	0.02847	±	0.02608	0.05171	60-DUP[b]	U	0.03349	±	0.02537	0.05866	100-DUP[b]	U	0.01425	±	0.02712	0.08853
21	U	0.04166	±	0.03751	0.10790	61	U	0.04396	±	0.04507	0.12020	101	U	0.04631	±	0.03996	0.07981
22	U	0.00816	±	0.01438	0.03875	62	U	0.02947	±	0.03004	0.06239	102	U	0.07831	±	0.06096	0.15080
23	U	0.06706	±	0.03781	0.10860	63	U	0.00309	±	0.02685	0.07274	103	U	0.03943	±	0.03910	0.07558
24	U	0.00524	±	0.02078	0.05151	64	U	0.00259	±	0.01958	0.04451	104	U	-0.00498	±	0.05170	0.11150
25	U	0.00857	±	0.02882	0.07831	65	U	0.00530	±	0.04293	0.09929	105	U	0.00709	±	0.01914	0.04812
26	U	0.03156	±	0.02332	0.05591	66	U	-0.00580	±	0.02059	0.04207	106	U	0.04017	±	0.04979	0.13360
27	U	0.10270	±	0.05143	0.14040	67	U	0.00383	±	0.02787	0.07558	107	U	0.03724	±	0.02766	0.06876
28	U	0.05151	±	0.03264	0.07369	68	U	0.02760	±	0.02129	0.05805	108	U	0.05054	±	0.04551	0.13090
29	U	-0.01054	±	0.03376	0.07200	69	U	0.07402	±	0.04944	0.13000	109	U	0.03759	±	0.02764	0.06405
30	U	-0.00843	±	0.01829	0.03605	70	U	0.03710	±	0.02667	0.06321	110	U	0.00515	±	0.03248	0.08811
30-DUP[b]	U	0.04151	±	0.02589	0.06170	70-DUP[b]	U	-0.00299	±	0.01749	0.03826	110-DUP[b]	U	0.01466	±	0.03765	0.10220
31	U	0.01839	±	0.03980	0.09962	71	U	0.01268	±	0.03255	0.08838	111	U	0.02771	±	0.03012	0.06360
32	U	0.04804	±	0.04020	0.11430	72	U	0.07694	±	0.04937	0.13690	112	U	0.00731	±	0.02155	0.05160
33	U	0.02523	±	0.02302	0.05254	73	U	0.01311	±	0.03978	0.09888	113	U	-0.02282	±	0.02563	0.02561
34	U	0.02587	±	0.03716	0.10010	74	U	0.01919	±	0.03579	0.09688	114	U	0.01126	±	0.02496	0.05828
35	U	0.04638	±	0.02499	0.06597	75	U	0.01242	±	0.02087	0.05065	115	U	0.01510	±	0.04580	0.11390
36	U	-0.00165	±	0.05273	0.10980	76	U	0.02035	±	0.03637	0.09840	116	U	0.00739	±	0.02177	0.05214
37	U	0.03009	±	0.01918	0.05268	77	U	0.02665	±	0.03216	0.09709	117	U	0.07150	±	0.05405	0.15130
38	U	0.01176	±	0.03730	0.09264	78	U	0.03986	±	0.03389	0.06640	118	U	0.06866	±	0.03168	0.08339
39	U	0.03513	±	0.02715	0.06050	79	U	0.01111	±	0.03226	0.08761	119	U	-0.01365	±	0.01802	0.02532
40	U	0.03500	±	0.03490	0.10200	80	U	0.01873	±	0.02825	0.06527	120	U	0.02377	±	0.02455	0.06224
40-DUP[b]	U	0.05713	±	0.03830	0.11000	80-DUP[b]	U	0.03305	±	0.02414	0.05981	120-DUP[b]	U	0.02646	±	0.02335	0.05770

Table 4
2007 Radon Flux Monitoring Results[a]
Niagara Falls Storage Site

NFSS Sample ID	Qualifier[d]	Radon-222 Flux (pCi/m²/s)			MDA
121	U	0.04015	±	0.05459	0.13780
122	U	0.03410	±	0.02317	0.05941
123	U	-0.00425	±	0.02578	0.06832
124	U	0.02433	±	0.02481	0.06290
125	U	0.06012	±	0.06143	0.15540
126	U	0.05349	±	0.02846	0.07311
127	U	0.07866	±	0.05002	0.14160
128	U	0.04437	±	0.02752	0.07318
129	U	-0.00339	±	0.04528	0.10170
130	U	0.01334	±	0.02535	0.05946
130-DUP[b]	U	0.04486	±	0.02729	0.06994
131	U	0.00507	±	0.03194	0.08664
132	U	-0.00384	±	0.03679	0.08723
133	U	0.01068	±	0.02465	0.05749
134	U	0.03303	±	0.05236	0.13180
135	U	0.03011	±	0.02965	0.06381
136	U	-0.00558	±	0.04564	0.10160
137	U	0.00779	±	0.02450	0.05664
138	U	0.04251	±	0.05702	0.14390
139	U	0.01713	±	0.02315	0.05866
140	U	0.01451	±	0.02763	0.09018
140-DUP[b]	U	-0.00301	±	0.05375	0.11670
141	U	0.04631	±	0.03790	0.07292
142	U	0.03414	±	0.05412	0.13630
143	U	0.05622	±	0.02931	0.07260
144	U	0.10130	±	0.06530	0.16200
145	U	0.04882	±	0.03858	0.08185
146	U	0.03244	±	0.05302	0.13340
147	U	0.00844	±	0.02999	0.06495
148	U	0.08603	±	0.05442	0.15230
149	U	-0.00001	±	0.01930	0.04489
150	U	0.05308	±	0.06013	0.15200
150-DUP[b]	U	0.09481	±	0.05107	0.14460
151	U	0.04649	±	0.02928	0.07290
152	U	0.05251	±	0.02908	0.08248
153	U	0.08933	±	0.05978	0.15310
154	U	0.03691	±	0.02610	0.06443
155	U	0.00491	±	0.04176	0.10200
156	U	0.04476	±	0.02891	0.07432
157	U	0.02492	±	0.04349	0.11760
158	U	0.04276	±	0.02242	0.06168
159	U	0.06019	±	0.05002	0.14200
160	U	0.04338	±	0.03018	0.07515
160-DUP[b]	U	0.04889	±	0.03184	0.07719
161	U	0.06761	±	0.06475	0.16380
162	U	0.05487	±	0.03618	0.08193
163	U	-0.04180	±	0.04618	0.07213
164		0.04206	±	0.01954	0.04854
165	U	0.00365	±	0.04164	0.10140
166	U	0.04058	±	0.03336	0.07783
167	U	0.01212	±	0.03701	0.10050
168	U	0.05375	±	0.02728	0.07290
169	U	0.00576	±	0.04279	0.10470
170	U	0.05424	±	0.03474	0.08198
170-DUP[b]	U	0.02835	±	0.03006	0.07026
171	U	0.02527	±	0.05095	0.12770
172	U	0.08522	±	0.06145	0.16470
173	U	0.03499	±	0.02591	0.06597
174	U	0.04342	±	0.05823	0.14700
175	U	0.03053	±	0.03274	0.06376
176	U	-0.01396	±	0.03334	0.07288
177	U	0.01363	±	0.02233	0.05649
178	U	0.07019	±	0.04866	0.13970
179	U	0.05428	±	0.03276	0.06870
180	U	0.03424	±	0.04782	0.12870
180-DUP[b]	U	0.00537	±	0.03385	0.09184
181[c]	U	0.05095	±	0.03905	0.08051
182[c]	U	0.00543	±	0.03420	0.09278
183[c]	U	0.00700	±	0.02898	0.06357
Average background	U	0.02113 (pCi/m²/s)			

	All Values	Units
Average:	0.02974	(pCi/m²/s)
High	0.10270	(pCi/m²/s)
Low	-0.04180	(pCi/m²/s)

NFSS Sample ID	Qualifier[d]	Radon-222 Flux (pCi/m²/s)	MDA

NOTE: The EPA Standard for Radon-222 Flux is 20 pCi/m²/sec (picocuries per square meter per second)

a. Radon-222 flux was performed on August 14-15, 2007

b. Every 10th canister is counted twice as a quality control (QC) duplicate to evaluate analytical precision.

c. Background: 181-Lewiston-Porter Central School
182-Balmer Rd. (CWM Secondary Gate)
183-Lewiston Water Pollution Control Center

d. Validated Qualifier: **U** - indicates that Radon-222 was not detected (Non-Detect).

Table 5
2007 Surface Water Analytical Results - Radioactive Constituents
Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[f]	Result (pCi/L)[a]		MDA[b] (pCi/L)[a]	DCG[c] (pCi/L)[a]
SWSD009	6/14/2007	Radium-226	U	0.322 ±	0.233	0.332	--
Background	6/14/2007	Radium-228	U	1.710 ±	1.280	2.030	--
		Total radium[d]		Non-detect			100
	6/14/2007	Thorium-230		0.397 ±	0.250	0.230	300
	6/14/2007	Thorium-232	U	-0.005 ±	0.143	0.357	50
	6/14/2007	Uranium-234	J	1.640 ±	0.398	0.221	--
	6/14/2007	Uranium-235		0.089 ±	0.101	0.089	--
	6/14/2007	Uranium-238	J	1.210 ±	0.340	0.178	--
		Total uranium[d]		*2.939*			*600*
SWSD021	6/14/2007	Radium-226	U	0.396 ±	0.321	0.492	--
Background	6/14/2007	Radium-228	U	-0.277 ±	0.737	1.540	--
		Total radium[d]		Non-detect			100
	6/14/2007	Thorium-230	U	0.146 ±	0.168	0.248	300
	6/14/2007	Thorium-232	U	0.136 ±	0.205	0.363	50
	6/14/2007	Uranium-234		3.880 ±	0.646	0.252	--
	6/14/2007	Uranium-235		0.329 ±	0.210	0.162	--
	6/14/2007	Uranium-238		3.710 ±	0.630	0.229	--
		Total uranium[d]		*7.919*			*600*
SWSD010	6/14/2007	Radium-226		0.428 ±	0.246	0.296	--
	6/14/2007	Radium-228	U	-0.077 ±	0.862	1.680	--
		Total radium[d]		*0.428*			100
	6/14/2007	Thorium-230		0.360 ±	0.268	0.240	300
	6/14/2007	Thorium-232	U	0.040 ±	0.148	0.351	50
	6/14/2007	Uranium-234		2.450 ±	0.525	0.202	--
	6/14/2007	Uranium-235	U	0.153 ±	0.159	0.218	--
	6/14/2007	Uranium-238		1.740 ±	0.455	0.287	--
		Total uranium[d]		*4.190*			*600*
SWSD011	6/14/2007	Radium-226		0.606 ±	0.323	0.426	--
	6/14/2007	Radium-228	U	-5.190 ±	1.040	2.830	--
		Total radium[d]		*0.606*			100
	6/14/2007	Thorium-230		0.329 ±	0.219	0.212	300
	6/14/2007	Thorium-232	U	0.061 ±	0.098	0.167	50
	6/14/2007	Uranium-234		2.240 ±	0.507	0.225	--
	6/14/2007	Uranium-235		0.251 ±	0.186	0.108	--
	6/14/2007	Uranium-238		2.070 ±	0.483	0.177	--
		Total uranium[d]		*4.561*			*600*

Table 5
2007 Surface Water Analytical Results - Radioactive Constituents
Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[f]	Result (pCi/L)[a]		MDA[b] (pCi/L)[a]	DCG[c] (pCi/L)[a]
Duplicate[e] SWSD011-D	6/14/2007	Radium-226	U	0.293 ±	0.293	0.474	--
SWSD011	6/14/2007	Radium-228	U	1.240 ±	1.030	1.640	--
		Total radium[d]		Non-detect			100
	6/14/2007	Thorium-230		0.571 ±	0.347	0.288	300
	6/14/2007	Thorium-232	U	0.248 ±	0.229	0.249	50
	6/14/2007	Uranium-234		2.060 ±	0.515	0.252	--
	6/14/2007	Uranium-235	U	0.141 ±	0.160	0.222	--
	6/14/2007	Uranium-238		2.220 ±	0.534	0.252	--
		Total uranium[d]		*4.280*			*600*
SWSD022	6/14/2007	Radium-226		0.805 ±	0.342	0.406	--
	6/14/2007	Radium-228	U	-1.350 ±	0.845	1.910	--
		Total radium[d]		*0.805*			100
	6/14/2007	Thorium-230		0.718 ±	0.384	0.285	300
	6/14/2007	Thorium-232		0.516 ±	0.338	0.339	50
	6/14/2007	Uranium-234		2.070 ±	0.477	0.216	--
	6/14/2007	Uranium-235	U	0.164 ±	0.152	0.165	--
	6/14/2007	Uranium-238		1.740 ±	0.434	0.154	--
		Total uranium[d]		*3.810*			*600*

a. pCi/L - picocuries per liter.

b. MDA - Minimum detectable activity.

c. DOE Derived Concentration Guide (DCG) for water.

d. Sum of isotope concentrations (pCi/L).

e. A quality control duplicate is collected at the same time and location and is analyzed by the same method for evaluating precision in sampling and analysis (SWSD011).

f. Validated Qualifier: **J** - indicates an estimated value.
Validated Qualifier: **U** - indicates that no analyte was detected (Non-Detect).

Table 6
2007 Sediment Analytical Results - Radioactive Constituents
Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[g]	Result (pCi/g)[a]	MDA[b] (pCi/g)[a]	Cleanup Criteria[c] (pCi/g)[a]
SWSD009	6/14/2007	Radium-226		0.878 ± 0.183	0.122	--
Background	6/14/2007	Radium-228		0.788 ± 0.320	0.283	--
		Total radium[e]		*1.666*		5
	6/14/2007	Thorium-230		1.290 ± 0.463	0.336	5
	6/14/2007	Thorium-232		1.290 ± 0.452	0.245	5
	6/14/2007	Uranium-233/234	J	1.940 ± 0.449	0.129	--
	6/14/2007	Uranium-235/236		0.217 ± 0.174	0.185	--
	6/14/2007	Uranium-238		1.590 ± 0.406	0.0809	--
		Total uranium[e]		*3.747*		*90*[d]
SWSD021	6/14/2007	Radium-226		0.809 ± 0.147	0.099	--
Background	6/14/2007	Radium-228		1.200 ± 0.287	0.178	--
		Total radium[e]		*2.009*		5
	6/14/2007	Thorium-230	J	0.736 ± 0.434	0.400	5
	6/14/2007	Thorium-232		1.070 ± 0.523	0.449	5
	6/14/2007	Uranium-233/234	J	1.180 ± 0.347	0.180	--
	6/14/2007	Uranium-235/236	U	0.088 ± 0.109	0.152	--
	6/14/2007	Uranium-238		0.863 ± 0.300	0.190	--
		Total uranium[e]		*2.043*		*90*[d]
SWSD010	6/14/2007	Radium-226		0.856 ± 0.279	0.179	--
	6/14/2007	Radium-228		1.140 ± 0.461	0.417	--
		Total radium[e]		*1.996*		5
	6/14/2007	Thorium-230		1.000 ± 0.385	0.242	5
	6/14/2007	Thorium-232		1.010 ± 0.382	0.204	5
	6/14/2007	Uranium-233/234	J	1.410 ± 0.400	0.285	--
	6/14/2007	Uranium-235/236	U	0.192 ± 0.175	0.232	--
	6/14/2007	Uranium-238		1.740 ± 0.440	0.279	--
		Total uranium[e]		*3.150*		*90*[d]
SWSD022	6/14/2007	Radium-226		1.630 ± 0.254	0.143	--
	6/14/2007	Radium-228		1.330 ± 0.332	0.222	--
		Total radium[e]		*2.960*		5
	6/14/2007	Thorium-230		1.850 ± 0.581	0.226	5
	6/14/2007	Thorium-232		1.500 ± 0.523	0.226	5
	6/14/2007	Uranium-233/234	J	1.040 ± 0.313	0.147	--
	6/14/2007	Uranium-235/236	U	0.150 ± 0.145	0.196	--
	6/14/2007	Uranium-238		1.330 ± 0.353	0.147	--
		Total uranium[e]		*2.370*		*90*[d]

Table 6
2007 Sediment Analytical Results - Radioactive Constituents
Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[g]	Result (pCi/g)[a]	MDA[b] (pCi/g)[a]	Cleanup Criteria[c] (pCi/g)[a]
SWSD011	6/14/2007	Radium-226		0.977 ± 0.224	0.143	--
	6/14/2007	Radium-228		1.290 ± 0.459	0.242	--
		Total radium[e]		*2.267*		5
	6/14/2007	Thorium-230		1.330 ± 0.441	0.242	5
	6/14/2007	Thorium-232		1.270 ± 0.427	0.203	5
	6/14/2007	Uranium-233/234	J	0.997 ± 0.345	0.302	--
	6/14/2007	Uranium-235/236	U	0.084 ± 0.133	0.242	--
	6/14/2007	Uranium-238		1.130 ± 0.359	0.281	--
		Total uranium[e]		*2.127*		*90*[d]
Duplicate[f] SWSD011-D *SWSD011*	6/14/2007	Radium-226		1.190 ± 0.228	0.156	--
	6/14/2007	Radium-228		0.943 ± 0.404	0.366	--
		Total radium[e]		*2.133*		5
	6/14/2007	Thorium-230		2.500 ± 0.627	0.264	5
	6/14/2007	Thorium-232		1.240 ± 0.438	0.120	5
	6/14/2007	Uranium-233/234		1.490 ± 0.410	0.227	--
	6/14/2007	Uranium-235/236	U	0.054 ± 0.124	0.257	--
	6/14/2007	Uranium-238		0.969 ± 0.326	0.155	--
		Total uranium[e]		*2.459*		*90*[d]

a. pCi/g - picocuries per gram.

b. MDA - Minimum detectable activity.

c. DOE above-background surface soil cleanup criteria, averaged over topmost 6 in. (15 cm) of soil. Because there are no standards for radioactive constituents in sediment, these soil values (without background added) are used as a basis for comparison of sediment results.

d. NFSS DOE site-specific cleanup criterion for total uranium.

e. Sum of isotope concentrations (pCi/g).

f. A quality control duplicate is collected at the same time and location and is analyzed by the same method for evaluating precision in sampling and analysis.

g. Validated Qualifier: **J** - indicates an estimated value.
Validated Qualifier: **U** - indicates that no analyte was detected (Non-Detect).

Table 7
2007 Field Parameter Summary
Niagara Falls Storage Site

Sampling Location	Date	Temperature (°F[a])	pH	Spec. Cond.[b] (uS/cm[c])	DO[d] (mg/L[e])	ORP[f] (mV[g])	Turbidity (NTU[h])	Volume Purged (Liters[i])	Discharge milliter PM[j]
GROUNDWATER									
A45	6/12/2007	71.1	6.76	2134	NA	170	13.8	2.24	108
A50	6/12/2007	66.9	7.25	1681	2.29	39	1.2	3.14	95
OW04B	6/13/2007	60.7	7.16	1625	0.23	-27	1.8	5.76	165
OW06B	6/11/2007	69.3	7.01	1729	NA	-53	3.2	2.20	108
OW13B	6/11/2007	60.7	6.69	2353	0.40	-92	0.6	2.73	105
OW15B	6/11/2007	66.6	7.29	1334	NA	163	15.9	2.13	114
OW17B	6/11/2007	58.3	7.17	1440	0.21	-5	0.4	3.36	120
B02W20S	6/12/2007	73.4	7.06	1287	NA	182	6.5	2.06	102
SURFACE WATER									
SWSD009	6/14/2007	79.0	7.87	2038	4.52	155	NA	NA	NA
SWSD010	6/14/2007	79.5	7.94	2030	5.44	154	NA	NA	NA
SWSD011	6/14/2007	74.0	7.60	1900	4.52	153	NA	NA	NA
SWSD021	6/14/2007	71.6	8.17	684	3.83	107	NA	NA	NA
SWSD022	6/14/2007	78.0	8.21	2029	3.99	117	NA	NA	NA

a. °F - Degrees Fahrenheit.
b. Spec. Cond. - Specific conductance.
c. uS/cm - microSiemens/centimeter.
d. DO - Dissolved oxygen.
e. mg/L - milligrams per liter.
f. ORP - Oxidation-Reduction potential.
g. mV - milliVolts.
h. NTU - Nephelometric turbidity units.
i. 1-Liter = 0.26 gallons
j. Milliter PM = milliter per minute (1000ml = 1.0 liter)

Table 8
2007 Groundwater Quality Results for Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[f]	Result (mg/L)[a]	Detection Limit (mg/L)[a]	Related Regulations[b] Federal[c] (mg/L)[a]	Related Regulations[b] State[d] (mg/L)[a]
B02W20S	6/12/2007	Chloride		10.2	2.0*	250	250
Background	6/12/2007	Fluroide		0.41	0.10*	4	1.5
	6/12/2007	Nitrogen, Nitrate	J	0.40	0.02*	10	10
	6/12/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/12/2007	Sulfate		342.0	25.0*	250	250
	6/12/2007	Calcium		72.2	0.210	NE	NE
	6/12/2007	Magnesium	J	118.0	0.064	NE	NE
	6/12/2007	Potassium	J	1.43	0.100	NE	NE
	6/12/2007	Sodium	J	55.3	0.011	NE	20
A45	6/12/2007	Chloride		58.2	4.0*	250	250
	6/12/2007	Fluroide		0.12	0.10*	4	1.5
	6/12/2007	Nitrogen, Nitrate	J	0.29	0.02*	10	10
	6/12/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/12/2007	Sulfate		792.0	50.0*	250	250
	6/12/2007	Calcium		288.0	0.210	NE	NE
	6/12/2007	Magnesium	J	139.0	0.064	NE	NE
	6/12/2007	Potassium	J	4.19	0.100	NE	NE
	6/12/2007	Sodium	J	44.4	0.011	NE	20
A50	6/12/2007	Chloride		23.1	2.0*	250	250
	6/12/2007	Fluroide		0.41	0.10*	4	1.5
	6/12/2007	Nitrogen, Nitrate	J	0.70	0.02*	10	10
	6/12/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/12/2007	Sulfate		596.0	50.0*	250	250
	6/12/2007	Calcium		134.0	0.210	NE	NE
	6/12/2007	Magnesium	J	163.0	0.064	NE	NE
	6/12/2007	Potassium	J	1.86	0.100	NE	NE
	6/12/2007	Sodium	J	73.3	0.011	NE	20
Duplicate[e](D1)	6/12/2007	Chloride		23.2	2.0*	250	250
A50	6/12/2007	Fluroide		0.33	0.10*	4	1.5
	6/12/2007	Nitrogen, Nitrate	J	0.10	0.02*	10	10
	6/12/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/12/2007	Sulfate		605.0	50.0*	250	250
	6/12/2007	Calcium		144.0	0.210	NE	NE
	6/12/2007	Magnesium	J	171.0	0.064	NE	NE
	6/12/2007	Potassium	J	2.01	0.100	NE	NE
	6/12/2007	Sodium	J	70.5	0.011	NE	20
OW04B	6/13/2007	Chloride		75.1	10.0*	250	250
	6/13/2007	Fluroide		0.57	0.10*	4	1.5
	6/13/2007	Nitrogen, Nitrate	J	0.49	0.02*	10	10
	6/13/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/13/2007	Sulfate		566.0	25.0*	250	250
	6/13/2007	Calcium	J	182.0	0.145	NE	NE
	6/13/2007	Magnesium	J	129.0	0.145	NE	NE
	6/13/2007	Potassium		2.1	0.058	NE	NE
	6/13/2007	Sodium	J	56.8	0.025	NE	20

Table 8
2007 Groundwater Quality Results for Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[f]	Result (mg/L)[a]	Detection Limit (mg/L)[a]	Related Regulations[b] Federal[c] (mg/L)[a]	Related Regulations[b] State[d] (mg/L)[a]
OW06B	6/11/2007	Chloride		32.2	4.0*	250	250
	6/11/2007	Fluroide	J	0.37	0.10*	4	1.5
	6/11/2007	Nitrogen, Nitrate		0.33	0.02*	10	10
	6/11/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/11/2007	Sulfate		557.0	25.0*	250	250
	6/11/2007	Calcium		124.0	0.021	NE	NE
	6/11/2007	Magnesium	J	206.0	0.064	NE	NE
	6/11/2007	Potassium	J	2.73	0.010	NE	NE
	6/11/2007	Sodium	J	66.2	0.011	NE	20
OW13B	6/11/2007	Chloride		39.9	4.0*	250	250
	6/11/2007	Fluroide	J	0.45	0.10*	4	1.5
	6/11/2007	Nitrogen, Nitrate	J	0.015	0.02*	10	10
	6/11/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/11/2007	Sulfate		1090.0	50.0*	250	250
	6/11/2007	Calcium		179.0	0.021	NE	NE
	6/11/2007	Magnesium	J	303.0	0.064	NE	NE
	6/11/2007	Potassium	J	1.86	0.010	NE	NE
	6/11/2007	Sodium	J	75.3	0.011	NE	20
OW15B	6/11/2007	Chloride		6.7	2.0*	250	250
	6/11/2007	Fluroide	J	0.57	0.10*	4	1.5
	6/11/2007	Nitrogen, Nitrate		0.27	0.02*	10	10
	6/11/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/11/2007	Sulfate		435.0	25.0*	250	250
	6/11/2007	Calcium		107.0	0.021	NE	NE
	6/11/2007	Magnesium	J	124.0	0.064	NE	NE
	6/11/2007	Potassium	J	1.18	0.010	NE	NE
	6/11/2007	Sodium	J	51.1	0.011	NE	20
OW17B	6/11/2007	Chloride		11.5	2.0*	250	250
	6/11/2007	Fluroide	J	0.38	0.10*	4	1.5
	6/11/2007	Nitrogen, Nitrate		0.058	0.02*	10	10
	6/11/2007	Nitrogen, Nitrite	U	0.02	0.02*	1	1
	6/11/2007	Sulfate		429.0	25.0*	250	250
	6/11/2007	Calcium		65.2	0.021	NE	NE
	6/11/2007	Magnesium	J	135.0	0.064	NE	NE
	6/11/2007	Potassium	J	1.85	0.010	NE	NE
	6/11/2007	Sodium	J	60.9	0.011	NE	20

a. mg/L - milligrams per liter.

b. Regulations presented pertain to drinking water quality and are listed for comparison only. No drinking water supply is obtained from groundwater at NFSS. NE - Not established.

c. Federal Safe Drinking Water Act maximum contaminant levels from EPA Drinking Water Regulations and Health Advisories (October 1996).

d. Water Quality Criteria (class GA) per 6 NYCRR, Part 703.

e. A quality control (QC) duplicate is collected at the same time and location and is analyzed by the same method for evaluating precision in sampling and analysis.

f. Validated Qualifier: **U** - indicates that no analyte was detected above reporting limit (Non-Detect).
Validated Qualifier: **J** - indicates an estimated value.

*Reporting Limit

Table 9
2007 Groundwater Analytical Results - Radioactive Constituents
Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[c]	Result[a] (pCi/L)[b]		MDA (pCi/L)[b]	DCG[d] (pCi/L)[b]
B02W20S	6/12/2007	Radium-226		0.212 ±	0.164	0.203	--
Background	6/12/2007	Radium-228	U	0.295 ±	0.988	1.810	--
		Total Radium [gh]		0.212			100
	6/12/2007	Thorium-230	U	0.025 ±	0.063	0.144	300
	6/12/2007	Thorium-232	U	0.069 ±	0.105	0.184	50
	6/12/2007	Uranium-234		4.380 ±	0.677	0.320	--
	6/12/2007	Uranium-235	U	0.212 ±	0.195	0.279	--
	6/12/2007	Uranium-238		2.940 ±	0.556	0.287	--
		Total Uranium [e]		7.320			*600*
A50	6/12/2007	Radium-226	U	0.332 ±	0.244	0.334	--
	6/12/2007	Radium-228	U	1.180 ±	1.210	2.010	--
		Total Radium [gh]	Non-Detect				100
	6/12/2007	Thorium-230	U	0.059 ±	0.117	0.233	300
	6/12/2007	Thorium-232	U	0.040 ±	0.112	0.252	50
	6/12/2007	Uranium-234		7.380 ±	0.906	0.307	--
	6/12/2007	Uranium-235		0.430 ±	0.249	0.214	--
	6/12/2007	Uranium-238		6.200 ±	0.825	0.199	--
		Total Uranium [e]		14.010			*600*
Duplicate (A50-D)[f]	6/12/2007	Radium-226	U	0.120 ±	0.215	0.387	--
A50	6/12/2007	Radium-228	U	1.010 ±	1.530	2.640	--
		Total Radium [gh]	Non-Detect				100
	6/12/2007	Thorium-230	U	0.065 ±	0.111	0.204	300
	6/12/2007	Thorium-232	U	0.037 ±	0.072	0.111	50
	6/12/2007	Uranium-234		7.100 ±	0.910	0.260	--
	6/12/2007	Uranium-235		1.320 ±	0.437	0.205	--
	6/12/2007	Uranium-238		6.910 ±	0.894	0.166	--
		Total Uranium [e]		15.330			*600*
OW04B	6/13/2007	Radium-226		0.523 ±	0.308	0.423	--
	6/13/2007	Radium-228	U	-0.570 ±	1.070	2.210	--
		Total Radium [gh]		0.523			100
	6/13/2007	Thorium-230		0.672 ±	0.437	0.344	300
	6/13/2007	Thorium-232	U	0.109 ±	0.205	0.397	50
	6/13/2007	Uranium-234		16.200 ±	1.440	0.232	--
	6/13/2007	Uranium-235		1.680 ±	0.513	0.123	--
	6/13/2007	Uranium-238		17.900 ±	1.510	0.0993	--
		Total Uranium [e]		35.780			*600*
OW13B	6/11/2007	Radium-226	U	0.159 ±	0.194	0.327	--
	6/11/2007	Radium-228	U	1.280 ±	1.040	1.640	--
		Total Radium [gh]	Non-Detect				100
	6/11/2007	Thorium-230	U	0.102 ±	0.182	0.342	300
	6/11/2007	Thorium-232	U	-0.041 ±	0.092	0.279	50
	6/11/2007	Uranium-234		13.800 ±	1.250	0.246	--
	6/11/2007	Uranium-235		0.578 ±	0.326	0.377	--
	6/11/2007	Uranium-238		11.200 ±	1.130	0.312	--
		Total Uranium [e]		25.578			*600*

Table 9
2007 Groundwater Analytical Results - Radioactive Constituents
Niagara Falls Storage Site

Sampling Location	Date Collected	Analyte	Qualifier[c]	Result[a] (pCi/L)[b]		MDA (pCi/L)[b]	DCG[d] (pCi/L)[b]
OW06B	6/11/2007	Radium-226	U	0.230 ±	0.250	0.412	--
	6/11/2007	Radium-228	U	0.988 ±	1.090	1.820	--
		Total Radium [gh]	Non-Detect				100
	6/11/2007	Thorium-230	U	0.308 ±	0.257	0.359	300
	6/11/2007	Thorium-232	U	-0.042 ±	0.123	0.359	50
	6/11/2007	Uranium-234		8.040 ±	0.897	0.125	--
	6/11/2007	Uranium-235		0.540 ±	0.261	0.154	--
	6/11/2007	Uranium-238		6.970 ±	0.836	0.125	--
		Total Uranium [e]		15.550			*600*
OW15B	6/11/2007	Radium-226	U	0.111 ±	0.154	0.266	--
	6/11/2007	Radium-228	U	0.512 ±	1.360	2.400	--
		Total Radium [gh]	Non-Detect				100
	6/11/2007	Thorium-230		0.205 ±	0.169	0.165	300
	6/11/2007	Thorium-232	U	0.079 ±	0.120	0.211	50
	6/11/2007	Uranium-234		6.460 ±	0.825	0.323	--
	6/11/2007	Uranium-235		0.429 ±	0.243	0.217	--
	6/11/2007	Uranium-238		4.480 ±	0.681	0.197	--
		Total Uranium [e]		11.369			*600*
OW17B	6/11/2007	Radium-226	U	0.264 ±	0.236	0.368	--
	6/11/2007	Radium-228	U	-1.050 ±	1.030	2.240	--
		Total Radium [gh]	Non-Detect				100
	6/11/2007	Thorium-230	U	0.063 ±	0.123	0.243	300
	6/11/2007	Thorium-232	U	-0.057 ±	0.090	0.294	50
	6/11/2007	Uranium-234		2.390 ±	0.509	0.301	--
	6/11/2007	Uranium-235		0.237 ±	0.182	0.199	--
	6/11/2007	Uranium-238		1.860 ±	0.450	0.279	--
		Total Uranium [e]		4.487			*600*
A45	6/12/2007	Radium-226		0.636 ±	0.318	0.352	--
	6/12/2007	Radium-228	U	0.704 ±	1.080	1.880	--
		Total Radium [gh]		0.636			100
	6/12/2007	Thorium-230	U	0.246 ±	0.219	0.267	300
	6/12/2007	Thorium-232	U	0.056 ±	0.126	0.267	50
	6/12/2007	Uranium-234		16.400 ±	1.340	0.288	--
	6/12/2007	Uranium-235		1.160 ±	0.402	0.231	--
	6/12/2007	Uranium-238		12.900 ±	1.190	0.238	--
		Total Uranium [e]		30.460			*600*

a. Results reported with (±) radiological error quoted at 2-sigma (95 percent confidence level).
b. pCi/L - picocuries per liter.
c. Validated Qualifier: **U** - indicates that no analyte was detected (Non-Detect)
Validated Qualifier: **J** - indicates an estimated value.
d. DOE derived concentration guide for water.
e. Sum of uranium isotope concentrations.
f. A quality control duplicate is collected at the same time and location and is analyzed by the same method for evaluating precision of sampling and analysis.
g. Sum of radium isotope concentrations.
h. Not included in averages for Section 5.6.2.3.

Table 10
2007 Groundwater Analytical Results - Metals
Niagara Falls Storage Site

Sampling Location	Date Collected	Detected Analyte	Qualifier[g]	Result (µg/L)[a]	Detection Limit (µg/L)[a]	Related Regulations[c] Federal[d] (µg/L)[a]	State[e] (µg/L)[a]
B02W20S	6/12/07	Copper		1.80	0.25	1300	200
Background	6/12/07	Lead	U	0.49	0.49	15	25
	6/12/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]
A45	6/12/07	Copper		9.00	0.25	1300	200
	6/12/07	Lead		0.91	0.49	15	25
	6/12/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]
OW04B	6/13/07	Copper		2.80	1.20	1300	200
	6/13/07	Lead	U	2.50	2.50	15	25
	6/13/07	Vanadium	U	2.1	2.1	NE[b]	NE[b]
OW06B	6/11/07	Copper		3.30	0.25	1300	200
	6/11/07	Lead		3.20	0.49	15	25
	6/11/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]
OW13B	6/11/07	Copper		3.70	0.25	1300	200
	6/11/07	Lead	U	0.49	0.49	15	25
	6/11/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]
OW15B	6/11/07	Copper		4.50	0.25	1300	200
	6/11/07	Lead	U	0.49	0.49	15	25
	6/11/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]
OW17B	6/11/07	Copper		2.60	0.25	1300	200
	6/11/07	Lead	U	0.49	0.49	15	25
	6/11/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]
A50	6/12/07	Copper		3.20	0.25	1300	200
	6/12/07	Lead	U	0.49	0.49	15	25
	6/12/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]
Duplicate	6/12/07	Copper		3.30	0.25	1300	200
A50	6/12/07	Lead	U	0.49	0.49	15	25
	6/12/07	Vanadium	U	16.0	16.0	NE[b]	NE[b]

a. µg/L - micrograms per liter.

b. NE - Not Established

c. Regulations presented pertain to drinking water quality and are listed for comparison only. No drinking water supply is obtained from groundwater at NFSS.

d. Federal Safe Drinking Water Act Maximum Contaminant Levels from EPA Drinking Water Regulations and Health Advisories (October 1996).

e. Water Quality Criteria (Class GA) per 6 NYCRR, Chapter X, Subchapter A.

f. A quality control duplicate is collected at the same time and location and is analyzed by the same method for evaluating precision in sampling and analysis.

g. Validated Qualifier: **U** - indicates that no analyte was detected above detection limit (Non-Detect).
Validated Qualifier: **J** - indicates an estimated value.

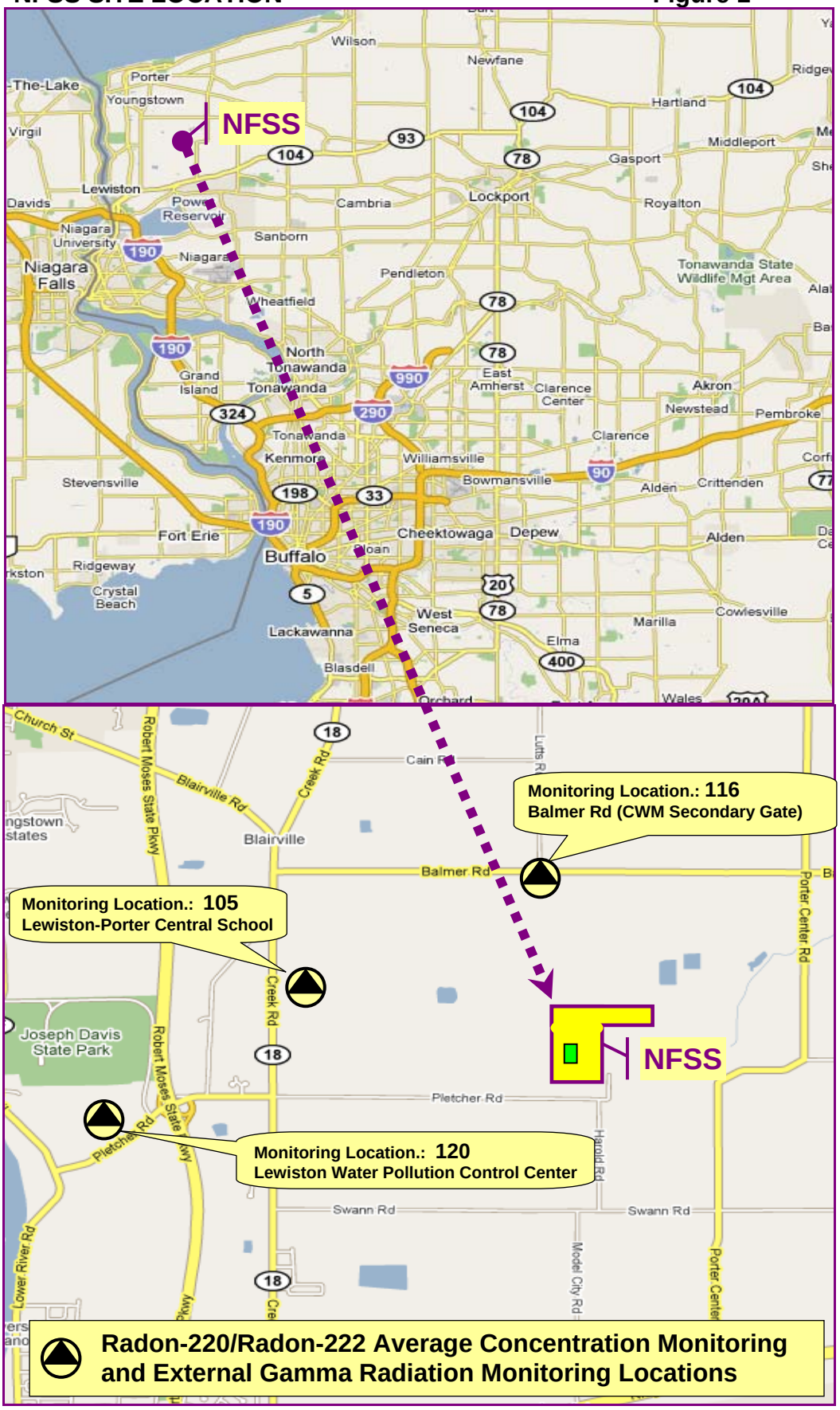
FUSRAP NIAGARA FALLS STORAGE SITE

2007

FIGURES

ENVIRONMENTAL SURVEILLANCE TECHNICAL MEMORANDUM

NFSS SITE LOCATION **Figure 1**



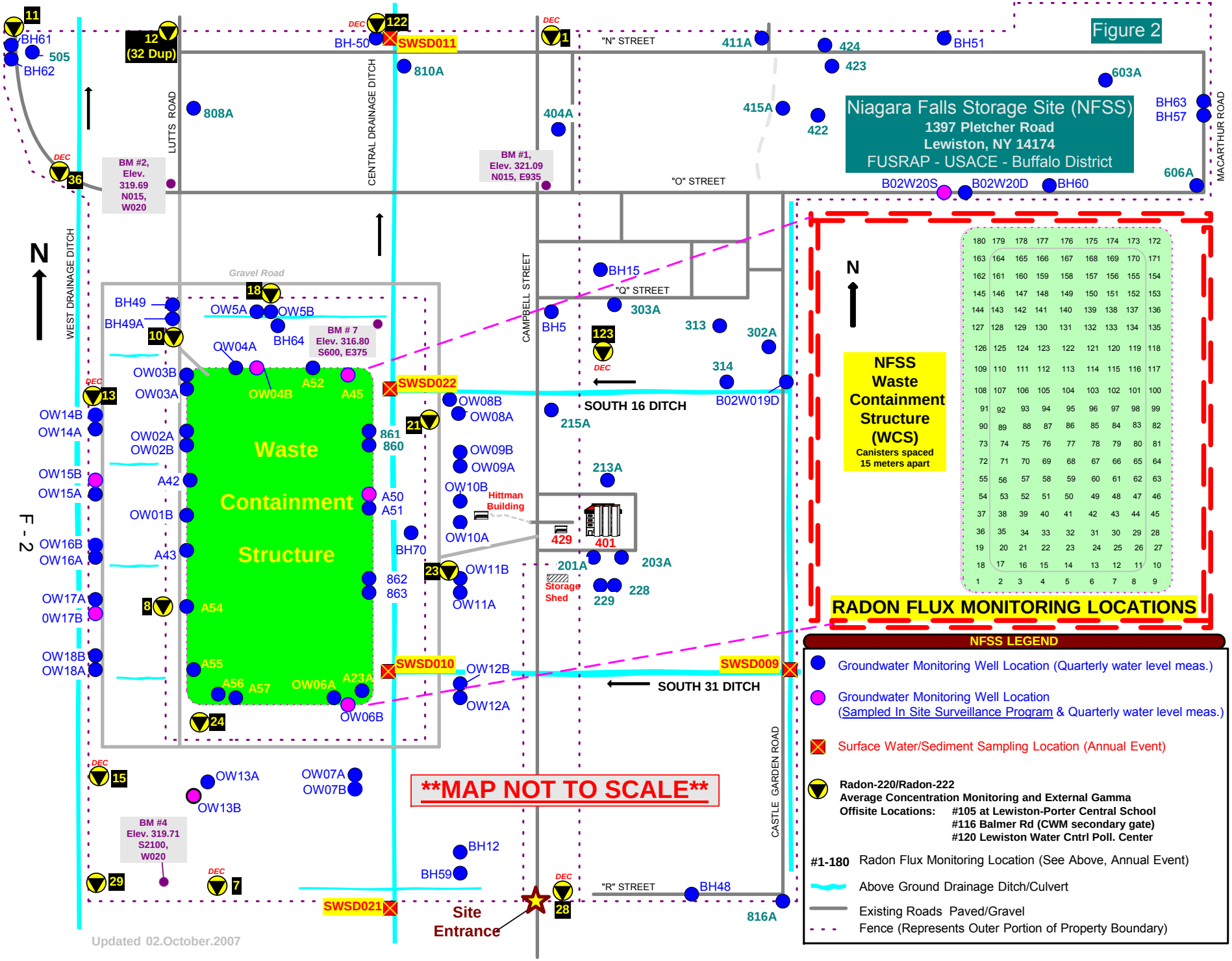


Figure 2
Niagara Falls Storage Site (NFSS)
1397 Pletcher Road
Lewiston, NY 14174
FUSRAP - USACE - Buffalo District
Waste Containment Structure
NFSS Waste Containment Structure (WCS)
Canisters spaced 15 meters apart
RADON FLUX MONITORING LOCATIONS
NFSS LEGEND
Groundwater Monitoring Well Location (Quarterly water level meas.)
Groundwater Monitoring Well Location (Sampled In Site Surveillance Program & Quarterly water level meas.)
Surface Water/Sediment Sampling Location (Annual Event)
Radon-220/Radon-222 Average Concentration Monitoring and External Gamma
Offsite Locations: #105 at Lewiston-Porter Central School
#116 Balmer Rd (CWM secondary gate)
#120 Lewiston Water Cntrl Poll. Center
#1-180 Radon Flux Monitoring Location (See Above, Annual Event)
Above Ground Drainage Ditch/Culvert
Existing Roads Paved/Gravel
Fence (Represents Outer Portion of Property Boundary)
MAP NOT TO SCALE
Site Entrance
SOUTH 16 DITCH
SOUTH 31 DITCH
"N" STREET
"O" STREET
"Q" STREET
"R" STREET
LUTTS ROAD
CENTRAL DRAINAGE DITCH
WEST DRAINAGE DITCH
CAMPBELL STREET
CASTLE GARDEN ROAD
MACARTHUR ROAD
Gravel Road
Hittman Building
Storage Shed
BM #1, Elev. 321.09 N015, E935
BM #2, Elev. 319.69 N015, W020
BM # 7 Elev. 316.80 S600, E375
BM #4 Elev. 319.71 S2100, W020
Updated 02.October.2007
F - 2

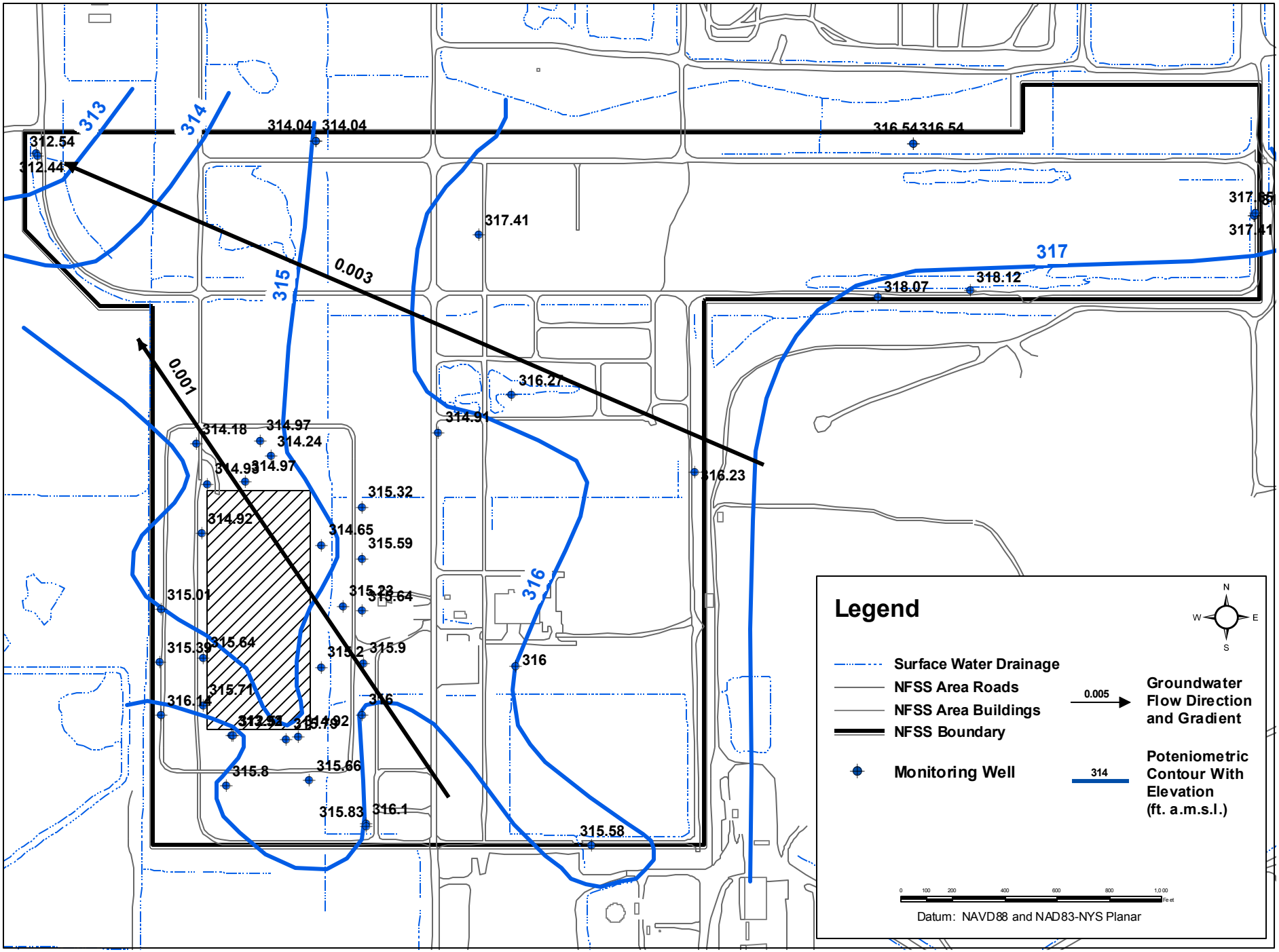


Figure 3
Seasonal High Potentiometric Surface Map (May 15, 2007)
Lower Groundwater System

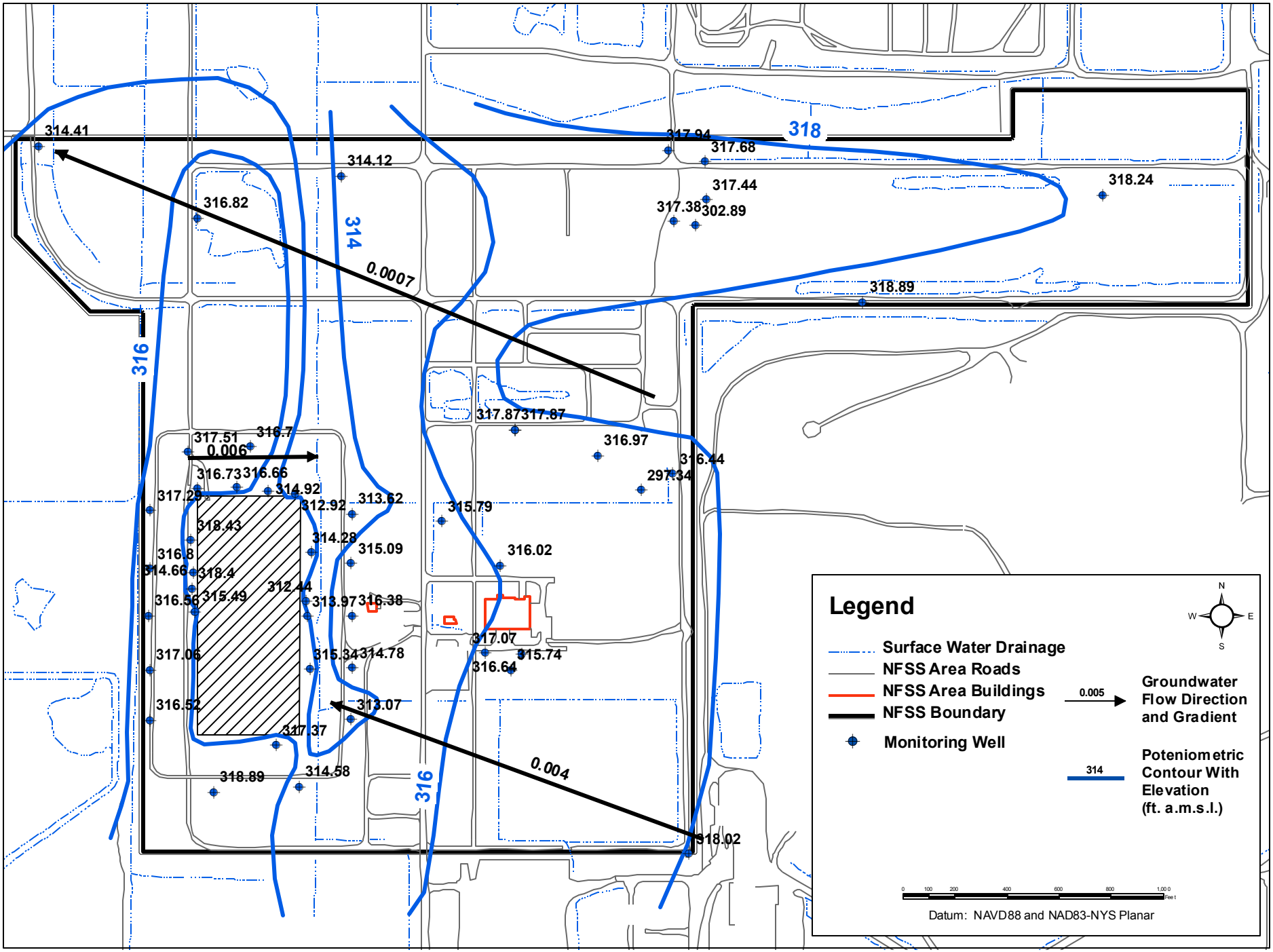


Figure 4
Seasonal High Potentiometric Surface Map (February 20, 2007)
Upper Groundwater System

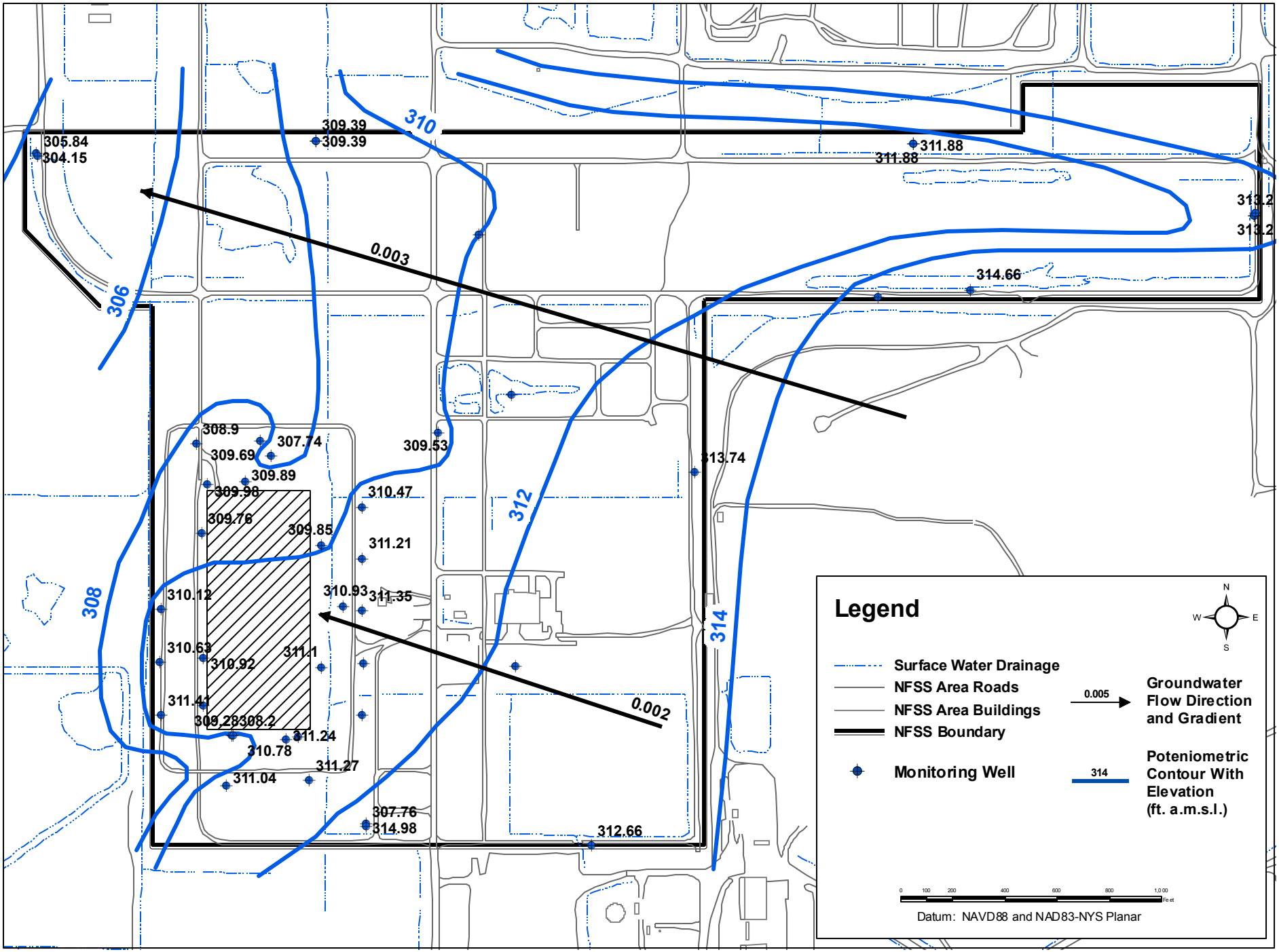
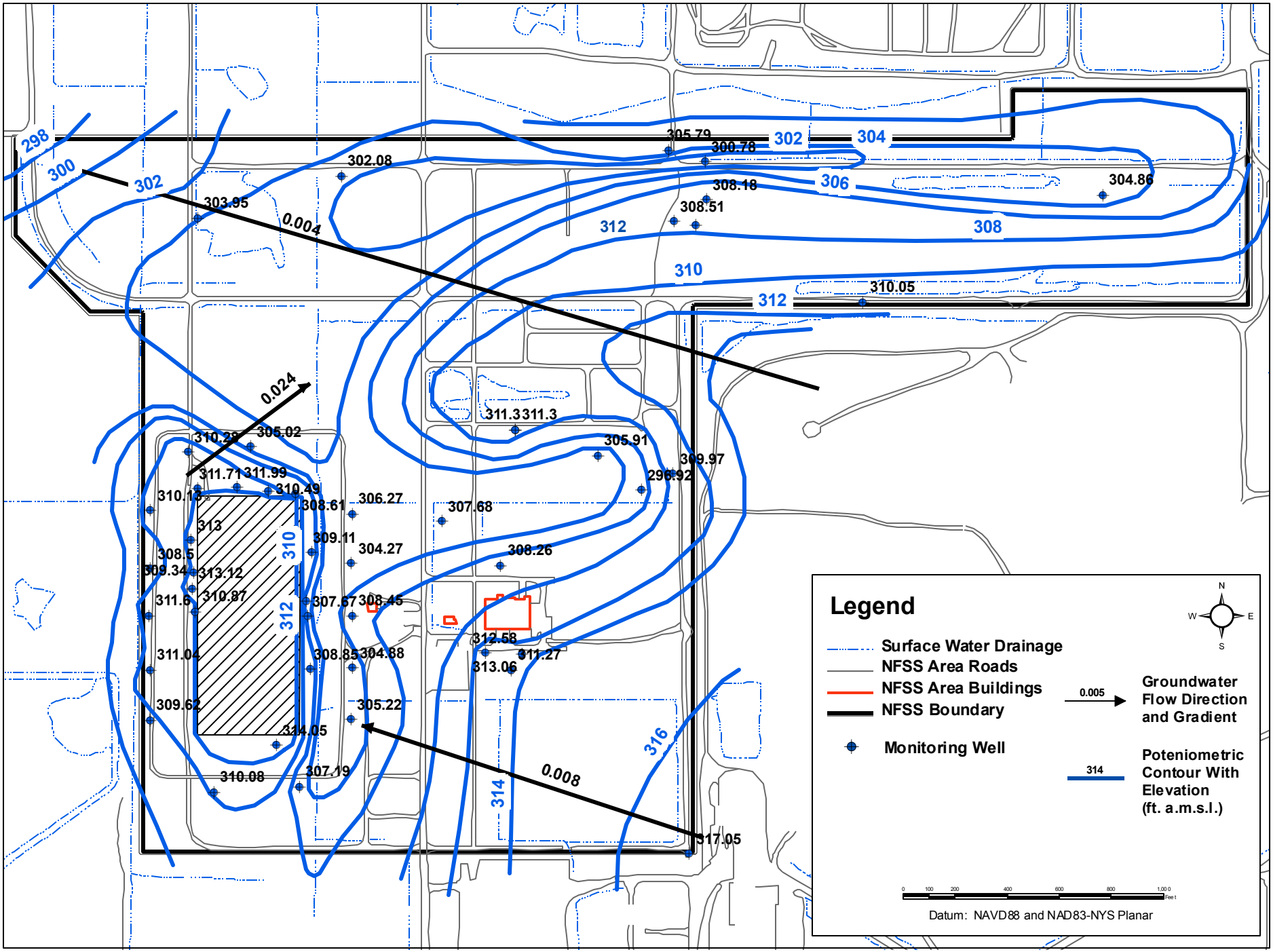
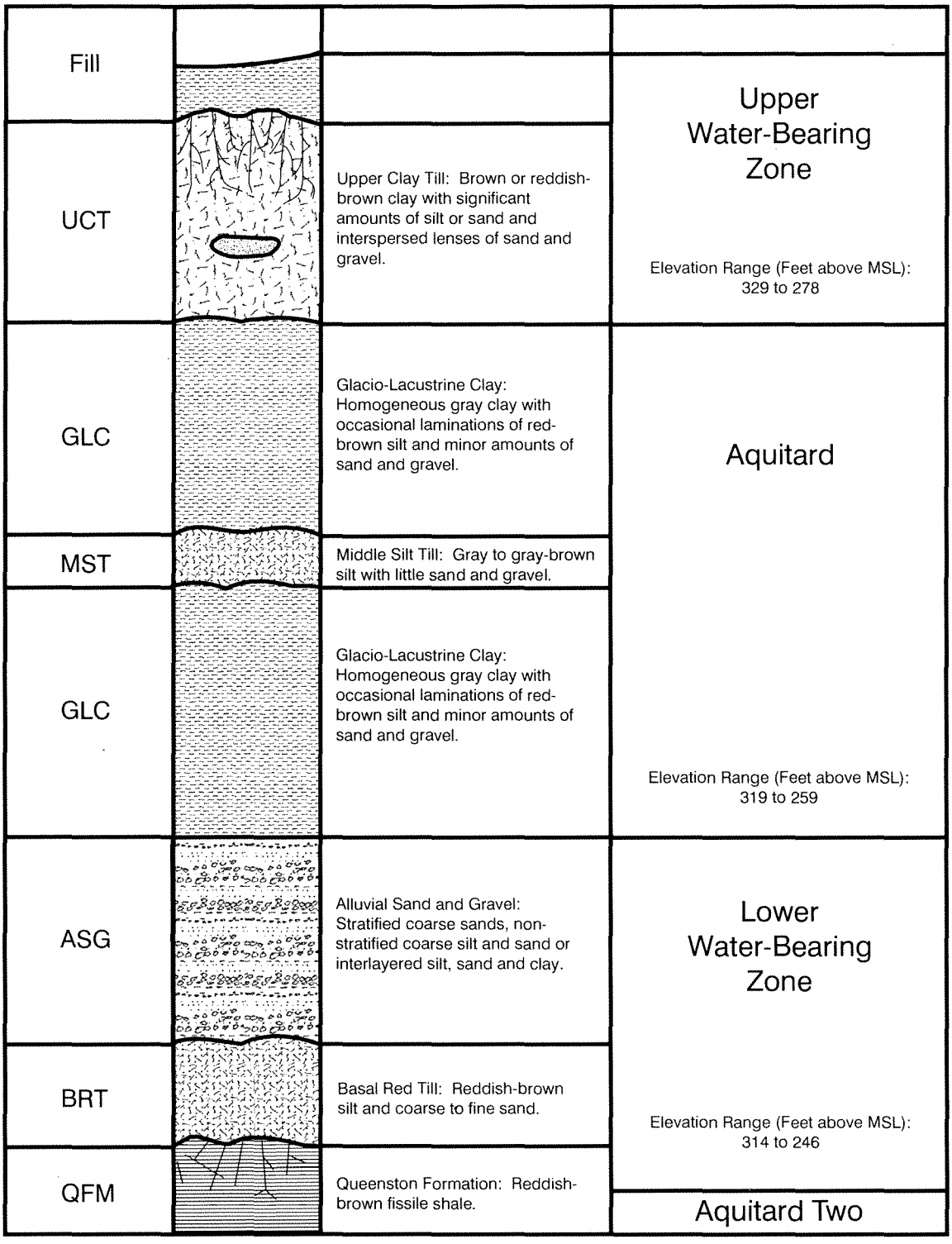


Figure 5
Seasonal Low Potentiometric Surface Map (October 16, 2007)
Lower Groundwater System



F-6

Figure 6
Seasonal Low Potentiometric Surface Map (October 16, 2007)
Upper Groundwater System



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Created by: apassarelli 03/26/02
Revised: 04/17/02 asp
Source: HydroGeoLogic, Inc., 2002

HYDRO GeoLogic INC.

Figure 2
Schematic of Conceptualized Hydrostratigraphy

Figure 8: Census Data

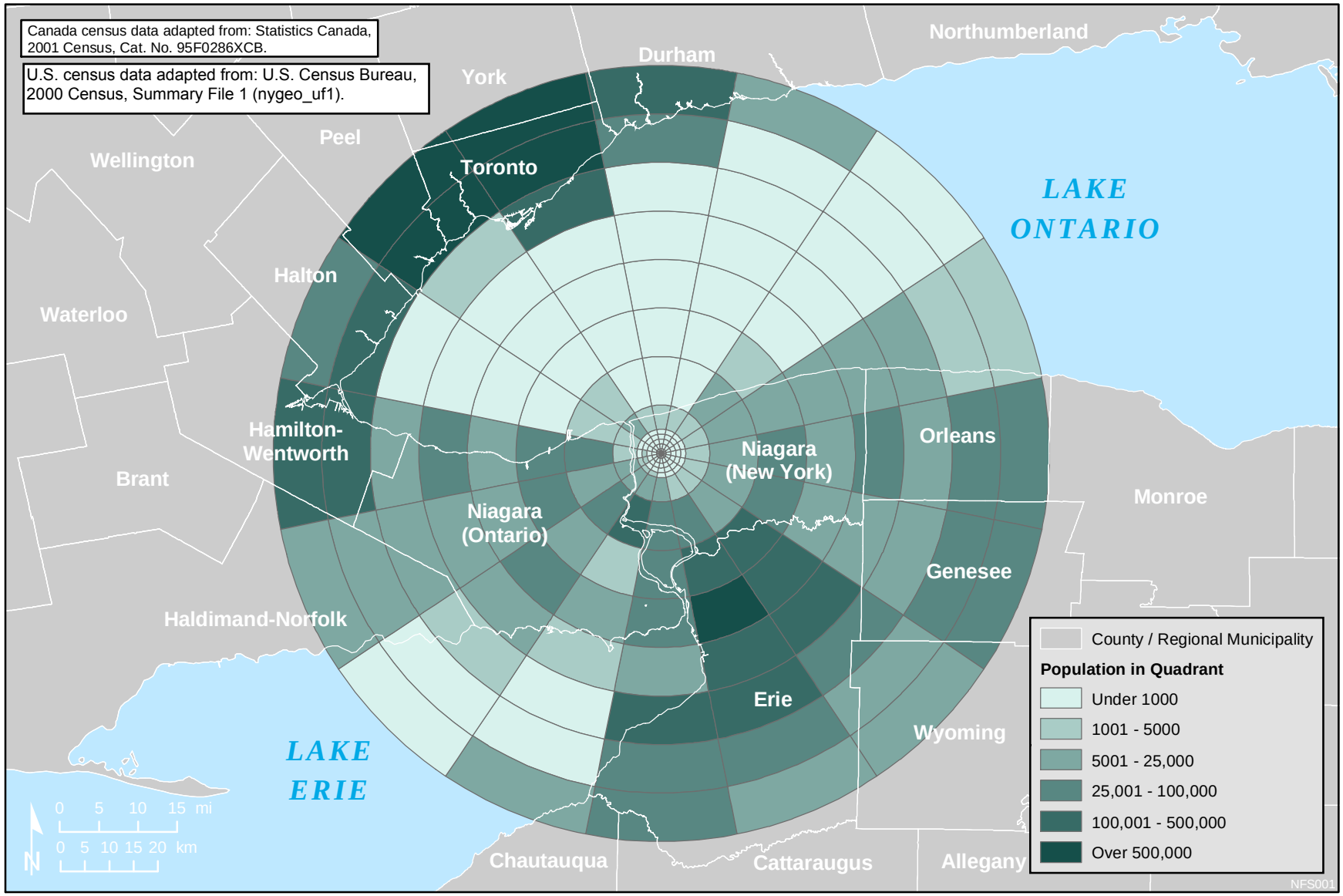
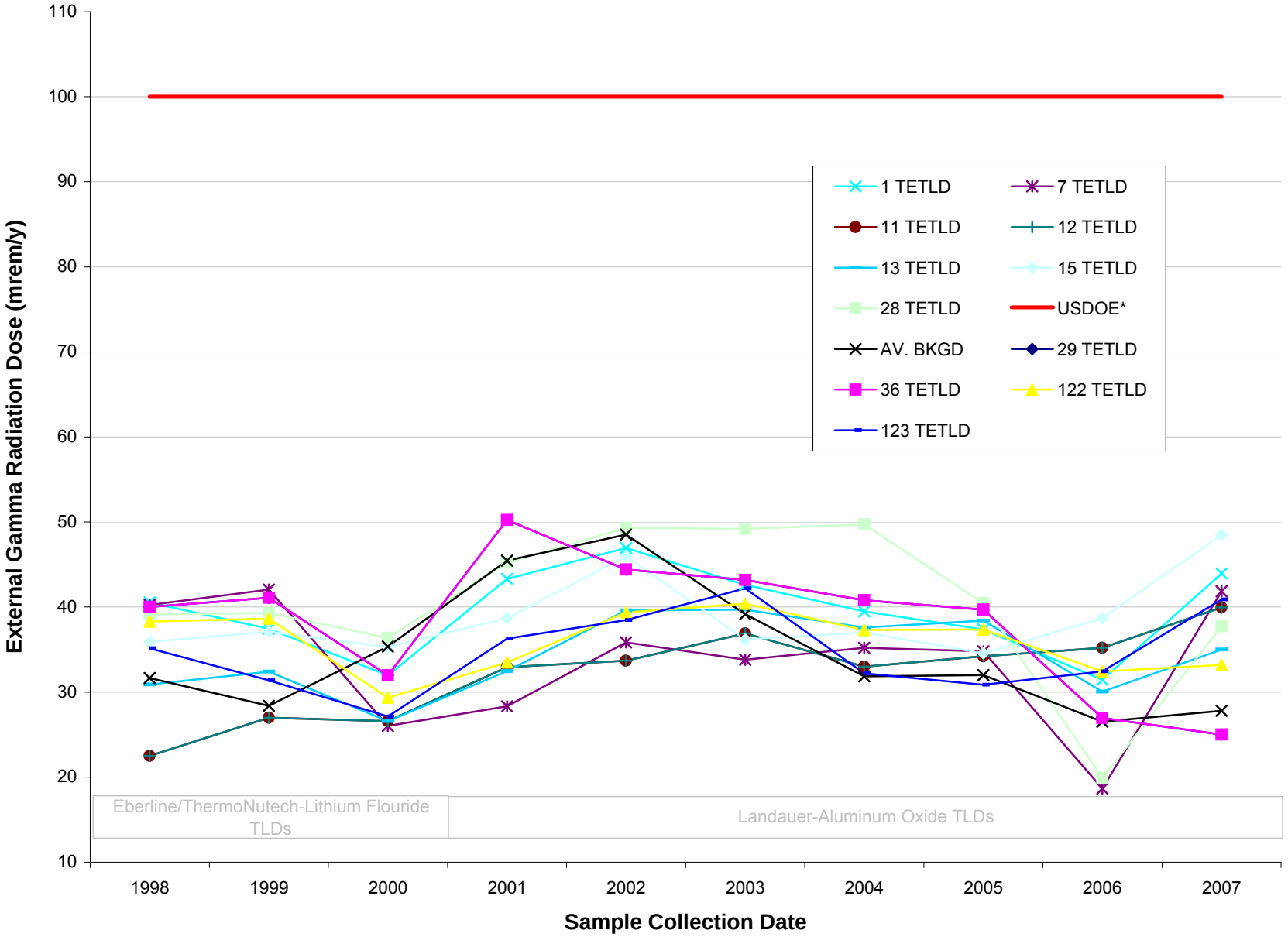
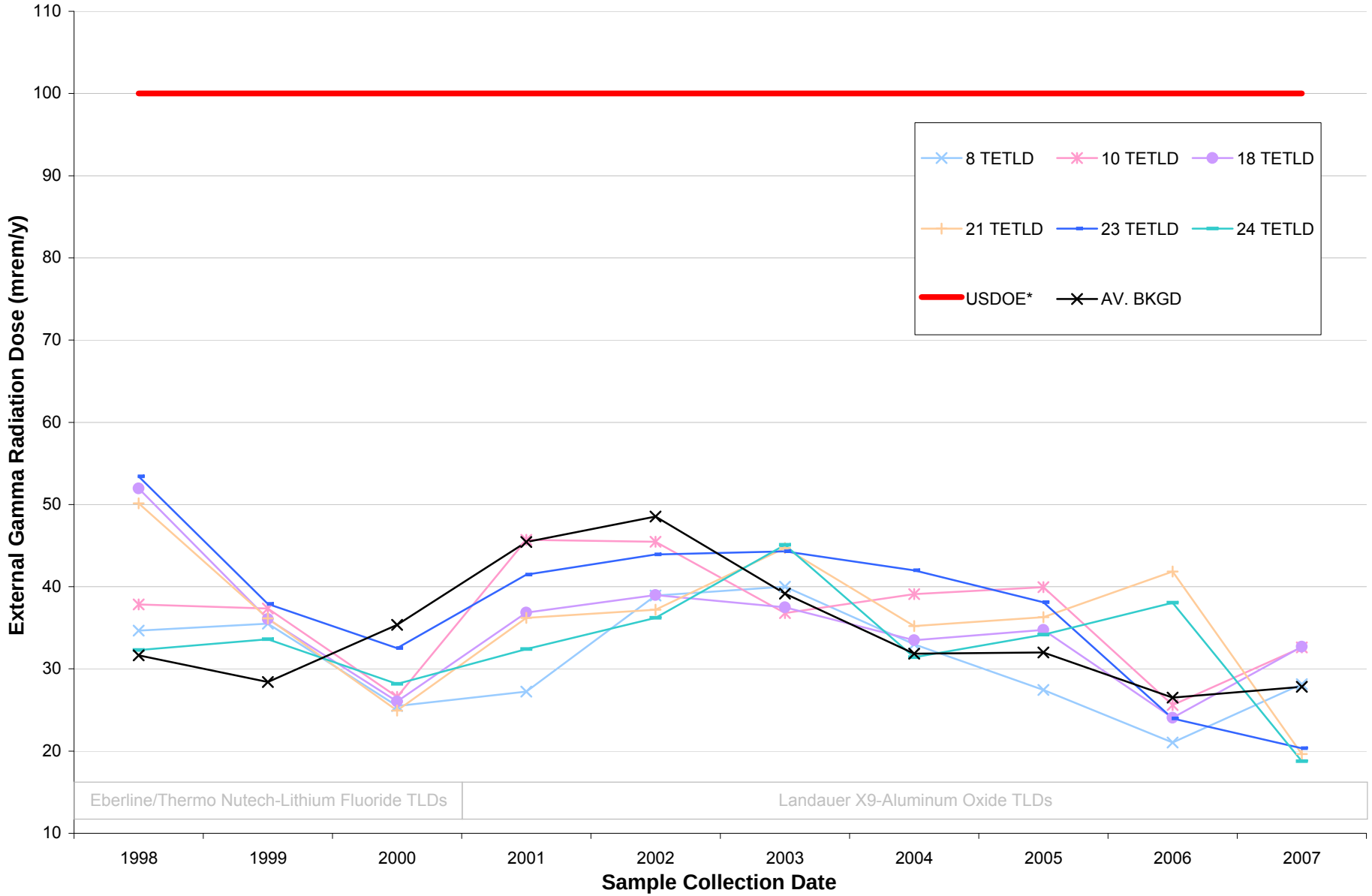


FIGURE 9: EXTERNAL GAMMA RADIATION DOSE RATES AT NFSS PERIMETER



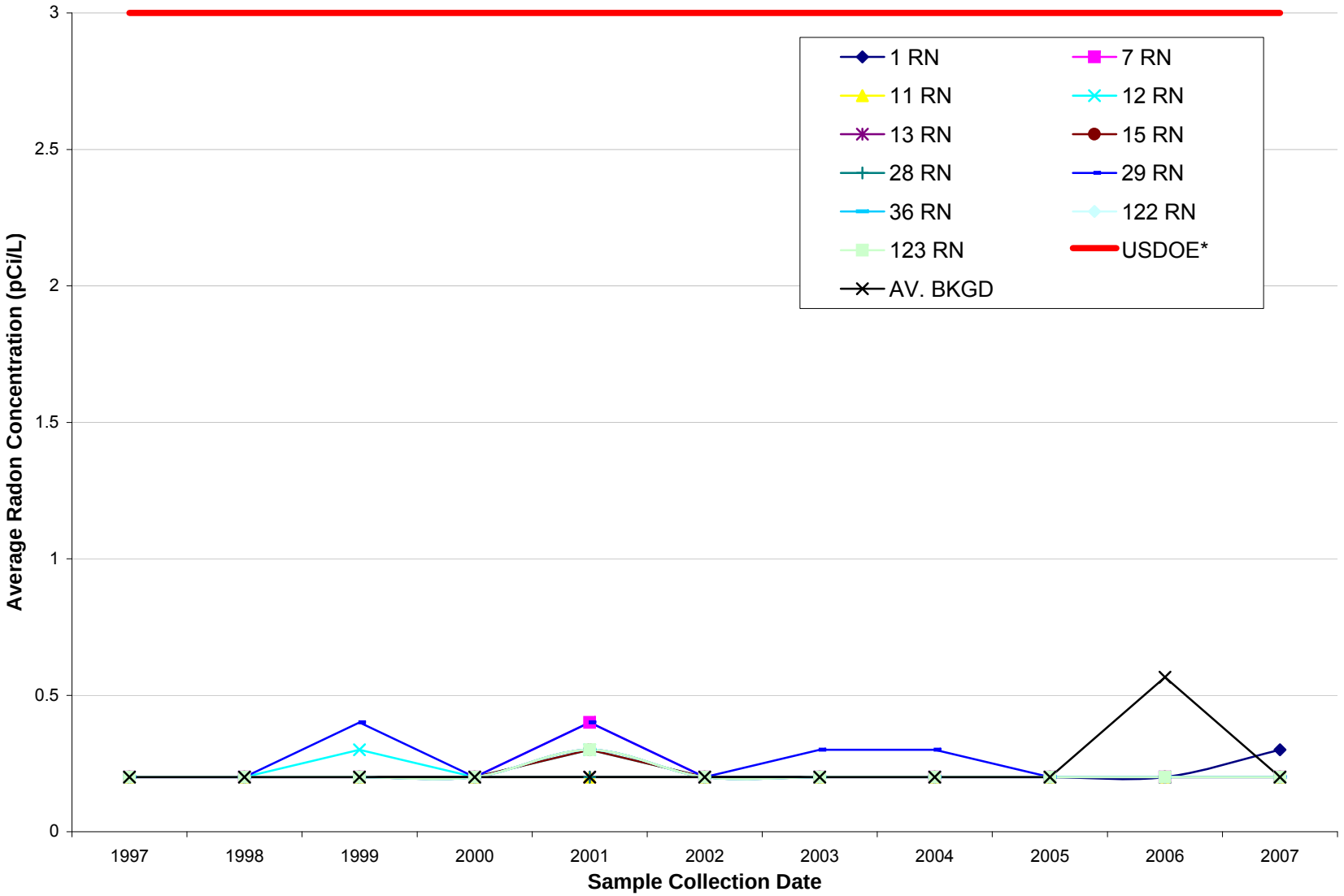
*The United States Department of Energy (USDOE) limit for external gamma radiation is 100 mrem/year above background.

FIGURE 10: EXTERNAL GAMMA RADIATION DOSE RATES AT IWCS PERIMETER



*The United States Department of Energy (USDOE) limit for external gamma radiation is 100 mrem/year above background.

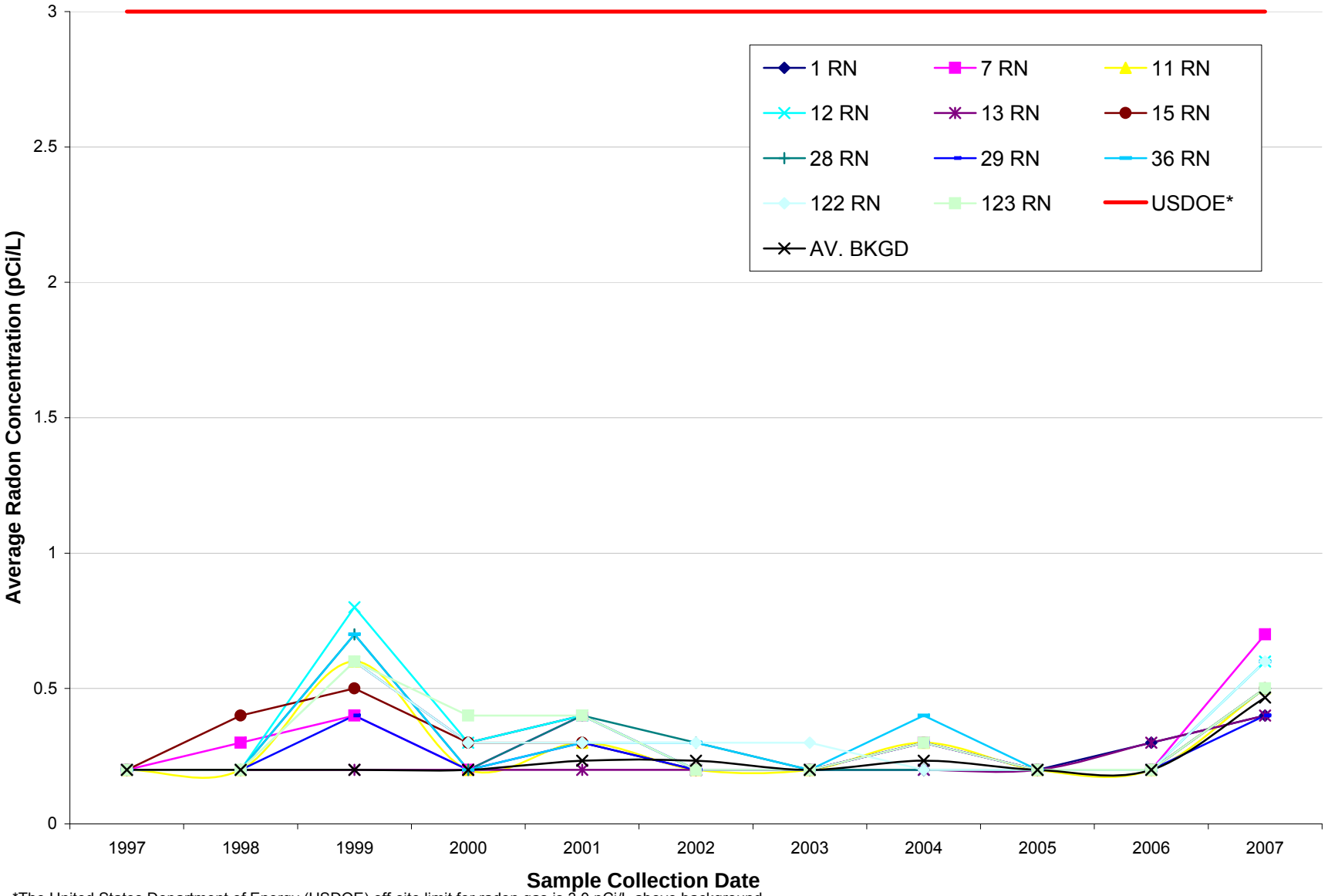
FIGURE 11: RADON GAS CONCENTRATION AT NFSS PERIMETER (JAN-JULY INTERVAL)



*The United States Department of Energy (USDOE) off-site limit for radon gas is 3.0 pCi/L above background.

Note: Above vlaues contain detects and non-deteects (dection limit is 0.2 pCi/L).

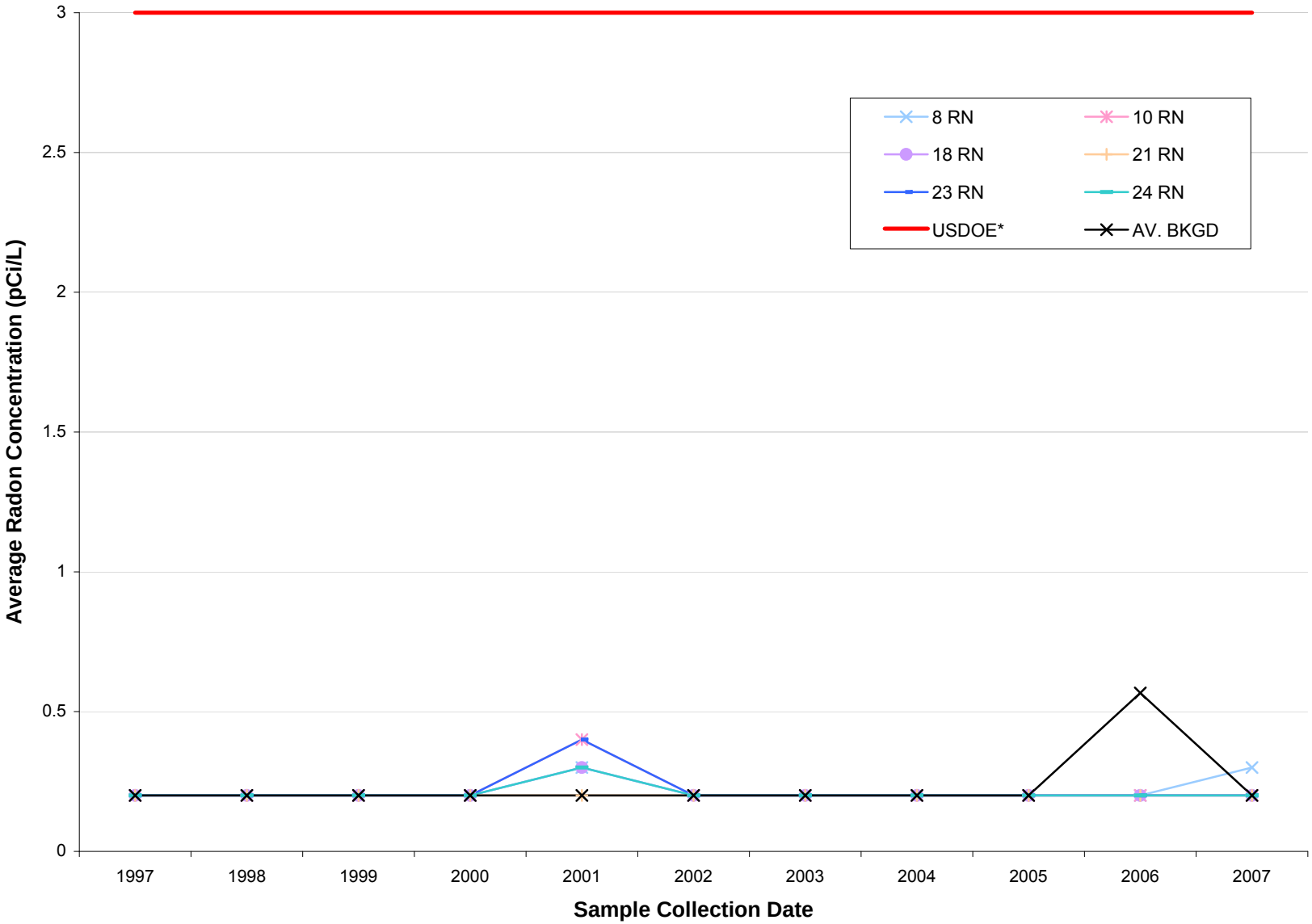
FIGURE 12: RADON GAS CONCENTRATION AT NFSS PERIMETER (JUL-JAN INTERVAL)



*The United States Department of Energy (USDOE) off-site limit for radon gas is 3.0 pCi/L above background.

** Monitors 1 , 10 and 24 RN were found in the snow (on the ground) for an unspecified amount of time. Therefore, those results for this exposure period were eliminated from the trend graph above.

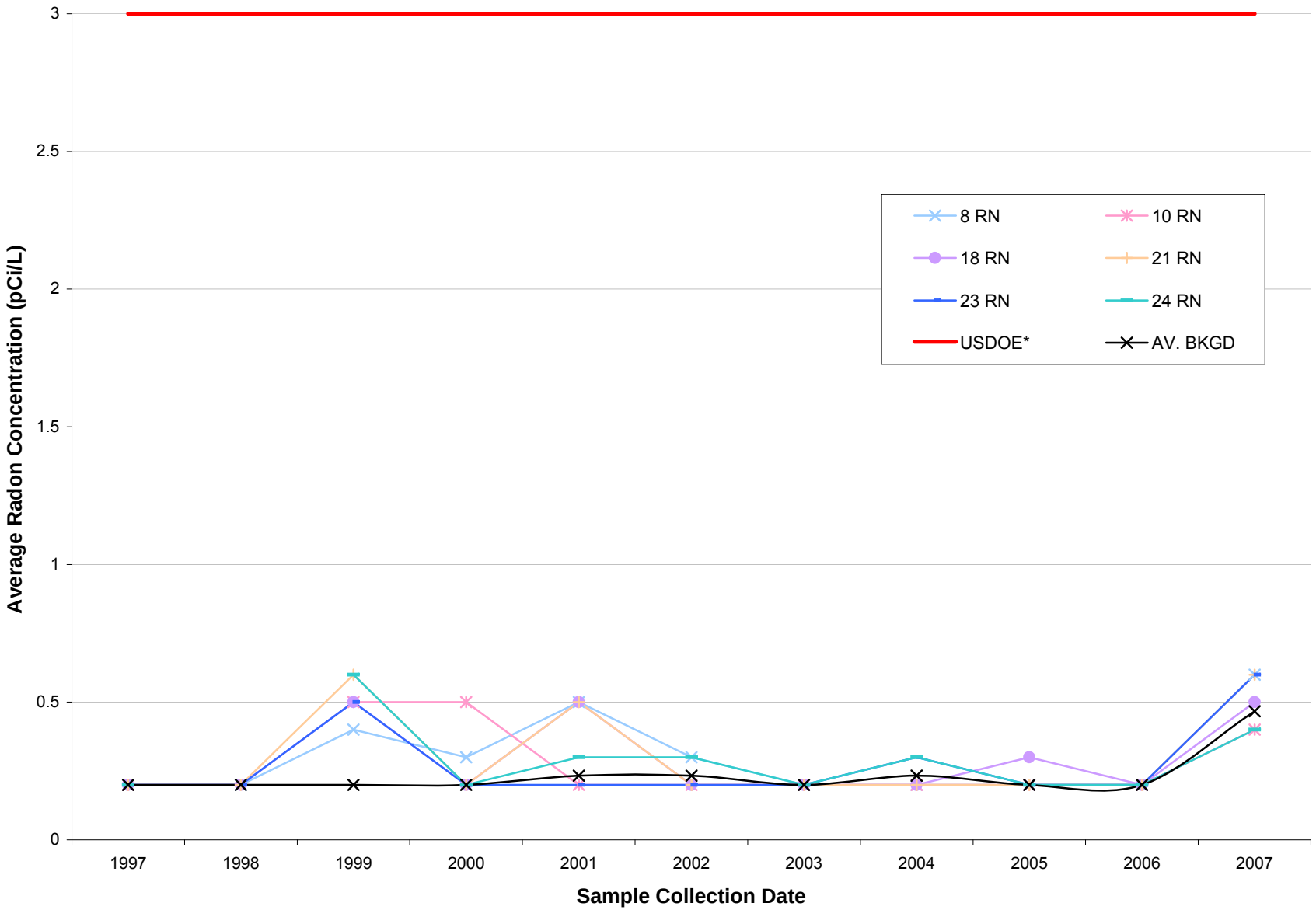
FIGURE 13: RADON GAS CONCENTRATION AT IWCS PERIMETER (JAN-JULY INTERVAL)



*The United States Department of Energy (USDOE) off-site limit for radon gas is 3.0 pCi/L above background.

Note: Above vlaues contain detects and non-deteects (dection limit is 0.2 pCi/L).

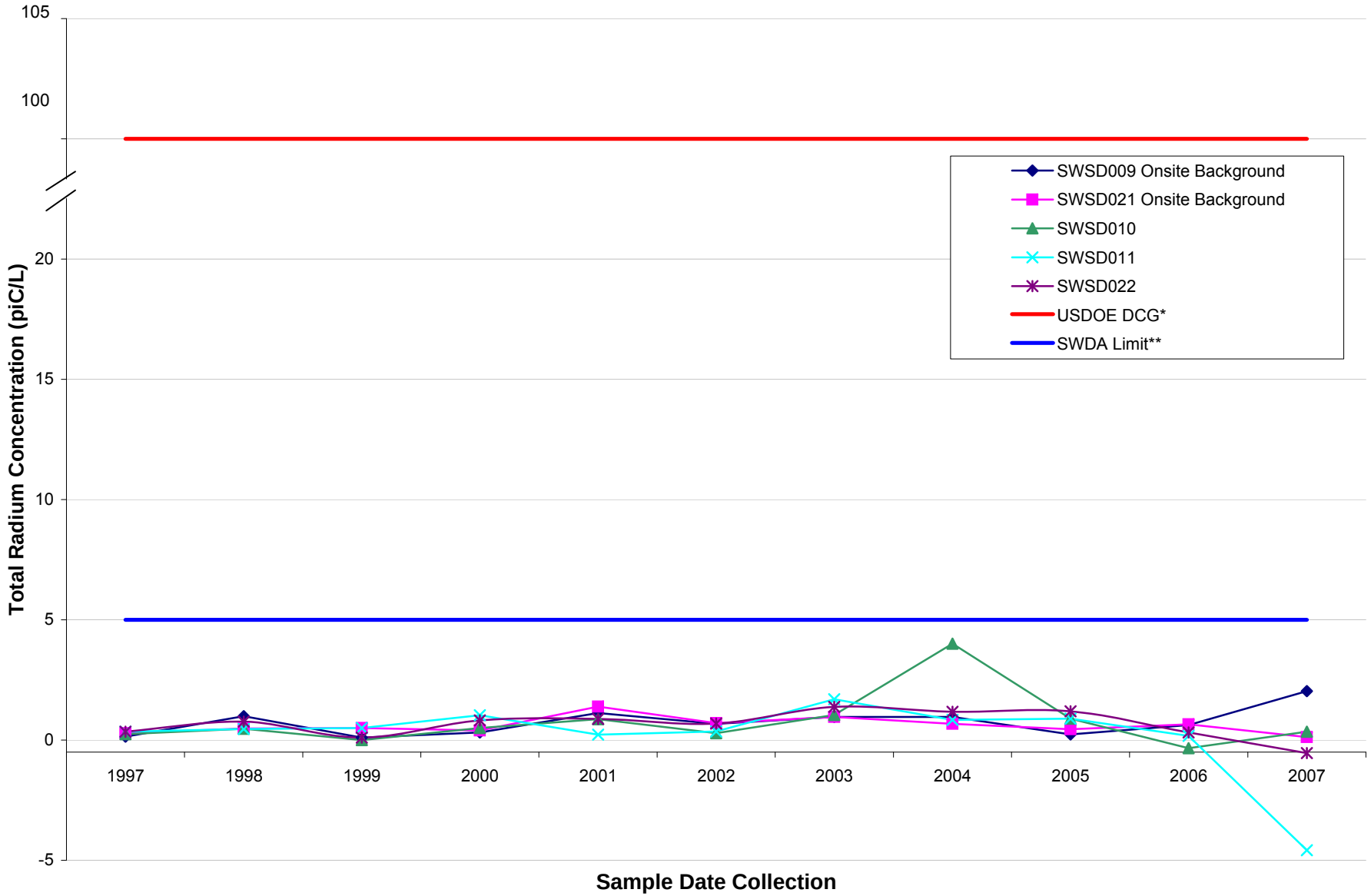
FIGURE 14: RADON GAS CONCENTRATION AT IWCS PERIMETER (JULY-JAN INTERVAL)



*The United States Department of Energy (USDOE) off-site limit for radon gas is 3.0 pCi/L above background.

Note: Above vlaues contain detects and non-deteects (dection limit is 0.2 pCi/L).

FIGURE 15: TOTAL RADIUM (RADIUM-226 AND RADIUM-228) CONCENTRATION IN SURFACE WATER



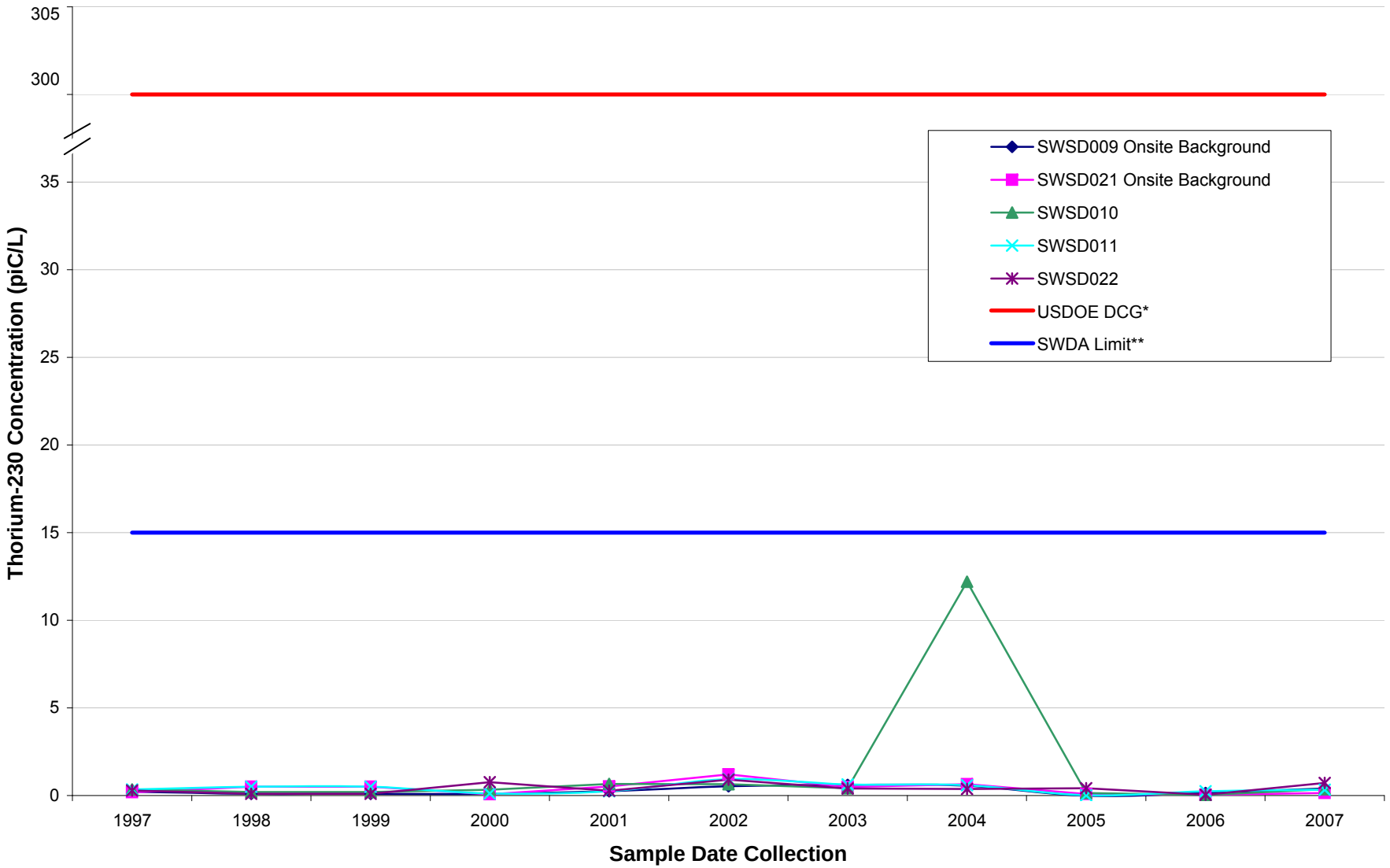
* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for Total Radium is 100 pCi/L.

**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Total Radium is 5 pCi/L. Surface water at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.

Note 1: 2004 findings for sample SWSD010 was attributed to excess turbidity of the sample.

Note 2: Above combined radium values include both detect and non-detect values.

FIGURE 16: THORIUM-230 CONCENTRATION IN SURFACE WATER



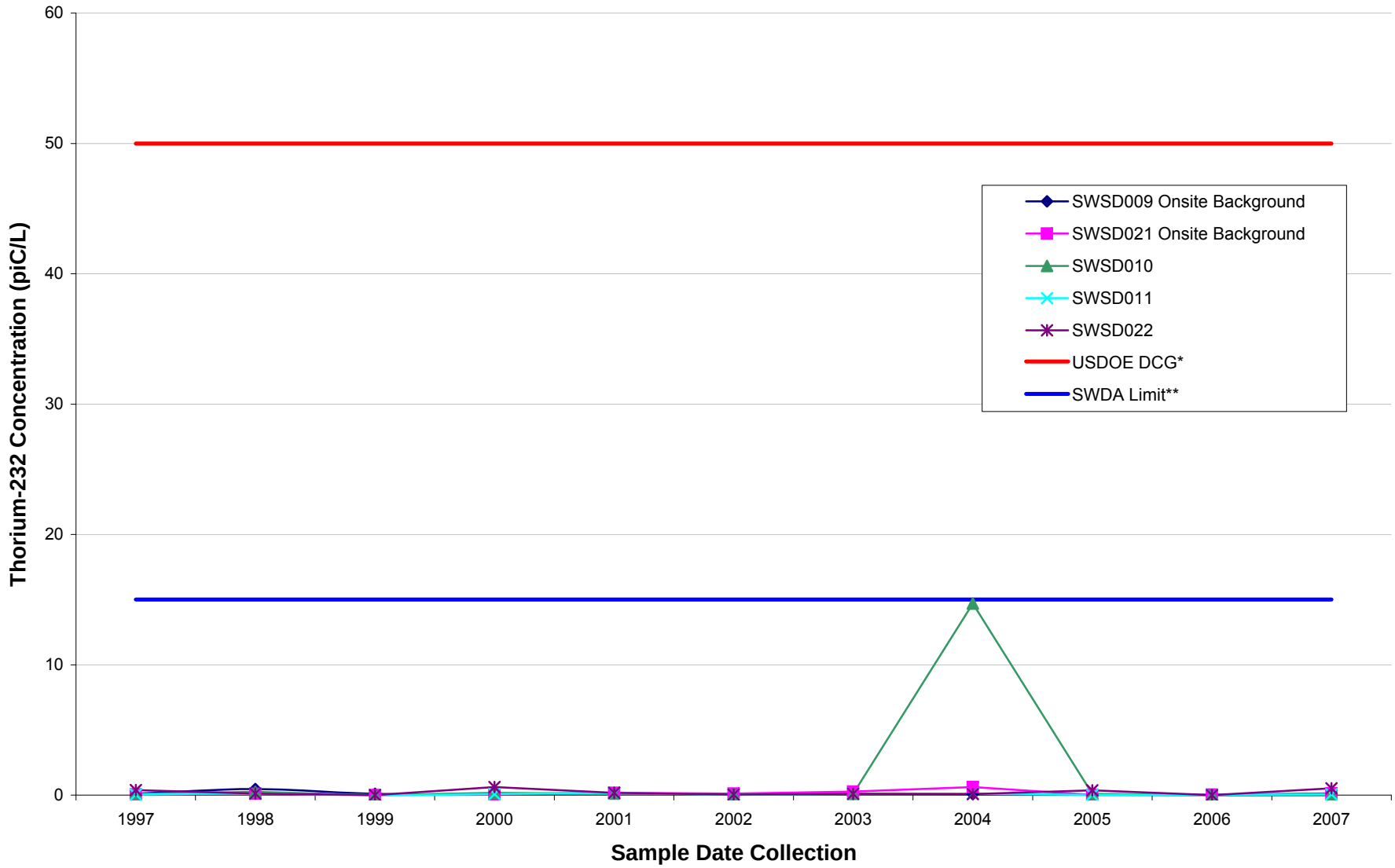
* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for Thorium-230 is 300 pCi/L.

**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Thorium-230 is 15 pCi/L. Surface water at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.

Note 1: 2004 findings for sample SWSD010 was attributed to excess turbidity of the sample.

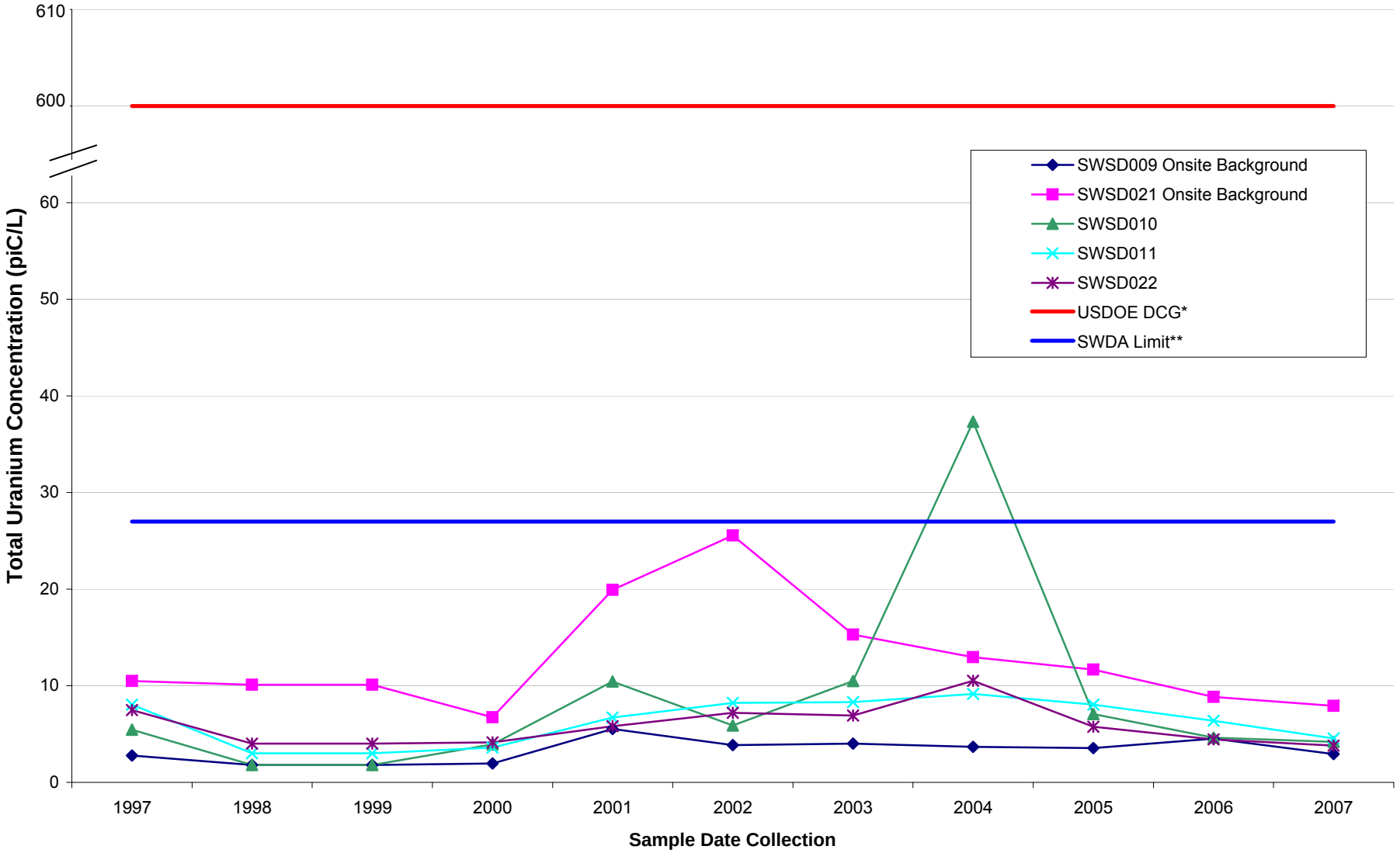
Note 2: Above thorium-230 values contain detect and non-detect results.

FIGURE 17: THORIUM-232 CONCENTRATION IN SURFACE WATER



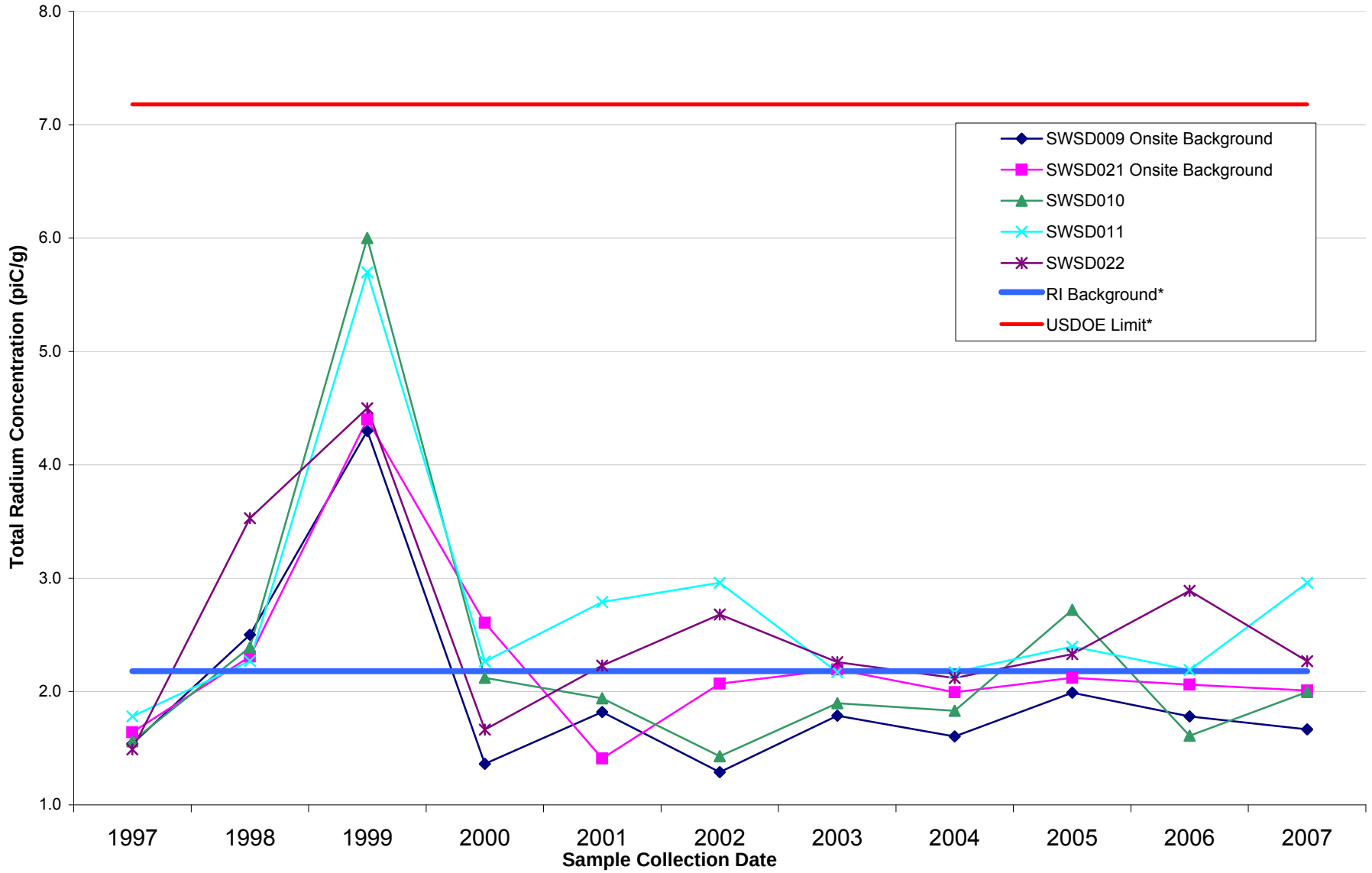
* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for Thorium-232 is 50 pCi/L.
**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Thorium-232 is 15 pCi/L. Surface water at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.
Note 1: 2004 findings for sample SWSD010 was attributed to excess turbidity of the sample.
Note 2: Above thorium-232 values contain detect and non-detect results

FIGURE 18: TOTAL URANIUM CONCENTRATION IN SURFACE WATER



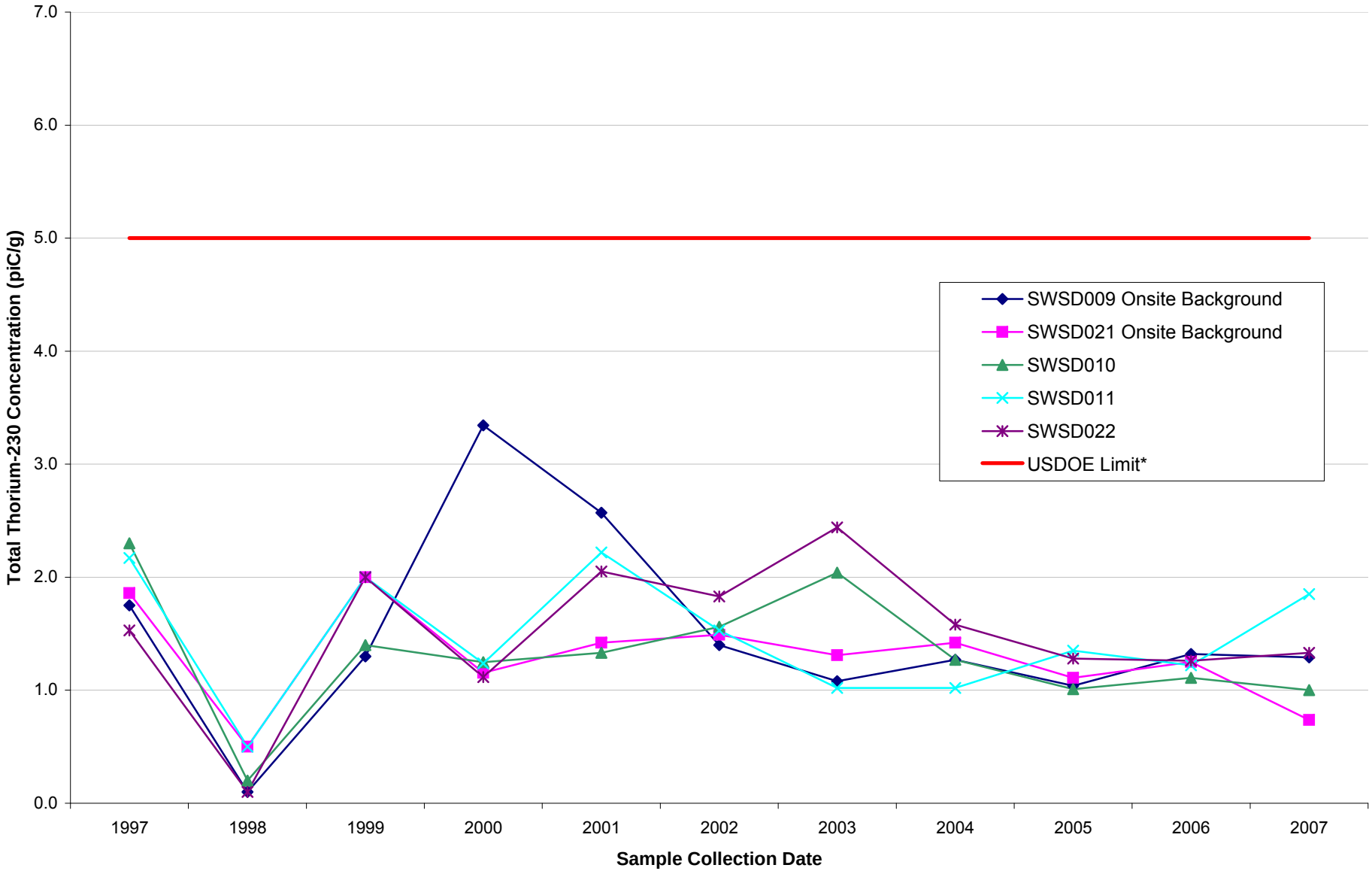
* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for Total Uranium is 600 pCi/L over background.
**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Total Uranium is 27 pCi/L. Surface water at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.
Note: 2004 findings for sample SWSD010 was attributed to excess turbidity of the sample.

FIGURE 19: TOTAL RADIUM (RADIUM-226 AND RADIUM-228) CONCENTRATION IN SEDIMENT



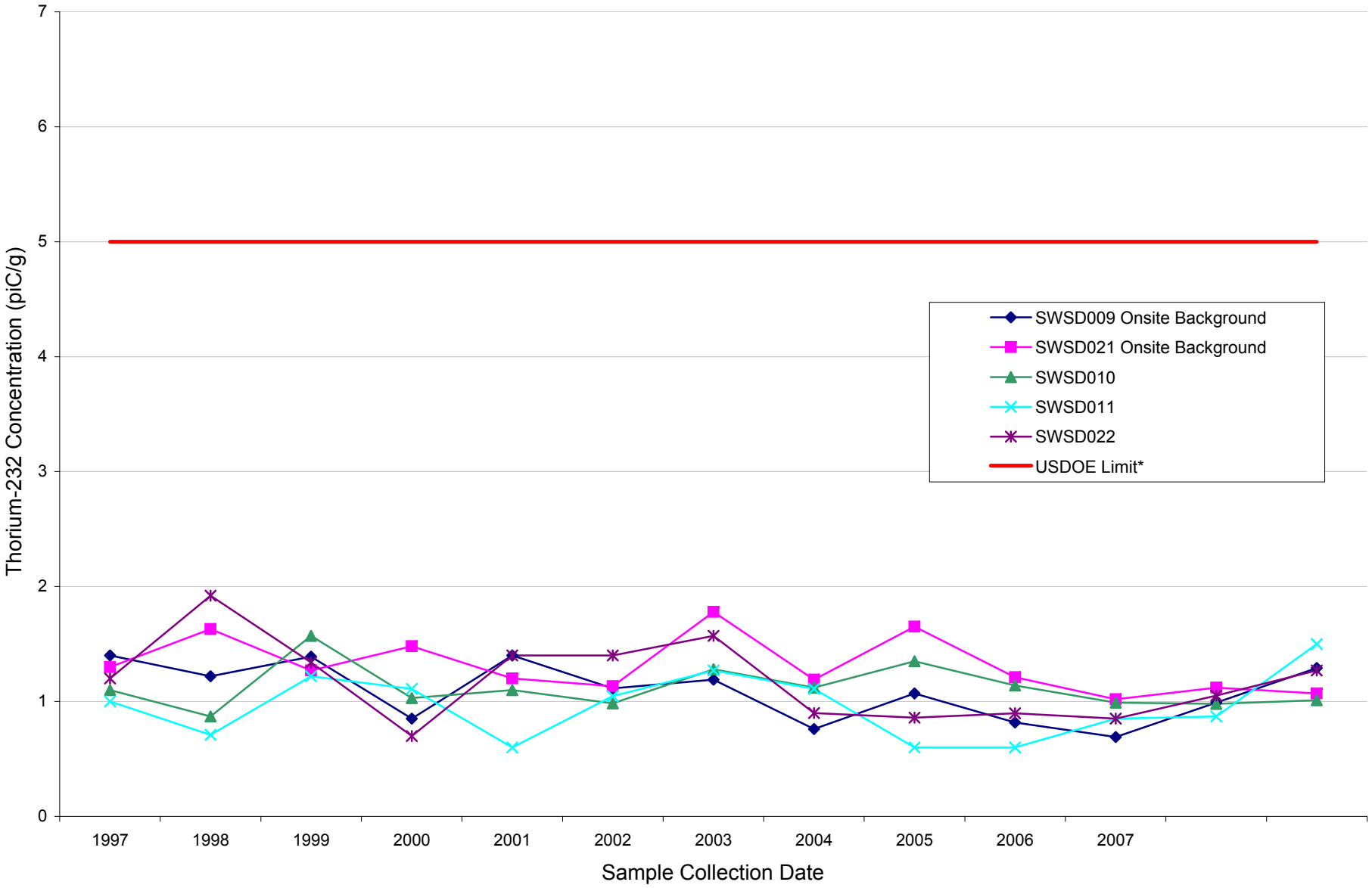
*The United States Department of Energy (USDOE) surface soil cleanup criterion for total radium is 5pCi/g above background. Above Background value of 7.18 pCi/g is obtained when 5 pCi/g is added to the NFSS surface soil RI background value of 2.18 pCi/g taken from the NFSS Remedial Investigation Report (December, 2007).

FIGURE 20: THORIUM-230 CONCENTRATION IN SEDIMENT



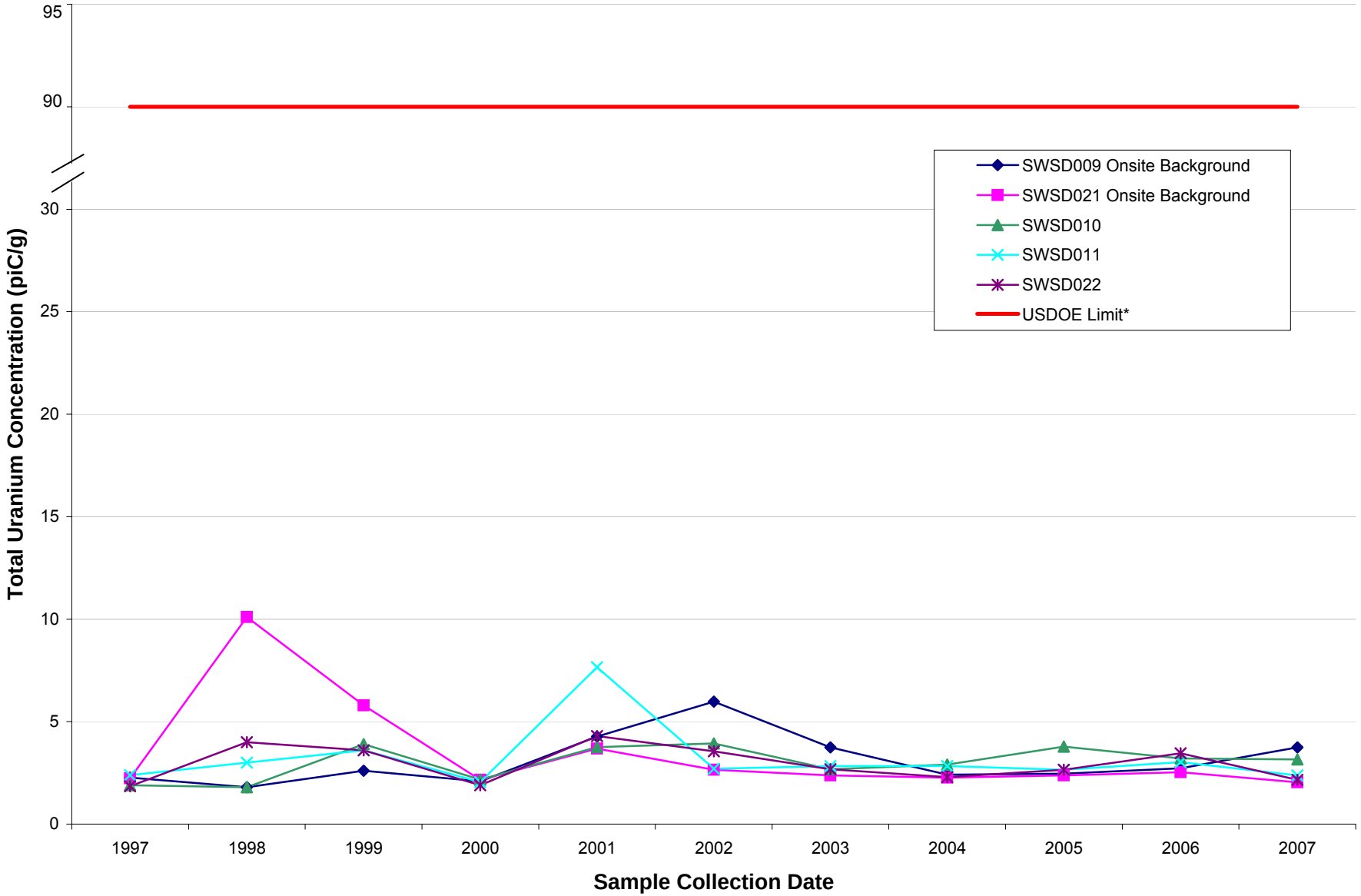
*The United States Department of Energy (USDOE) surface soil cleanup criterion for total thorium is 5pCi/g above background.

FIGURE 21: THORIUM-232 CONCENTRATION IN SEDIMENT



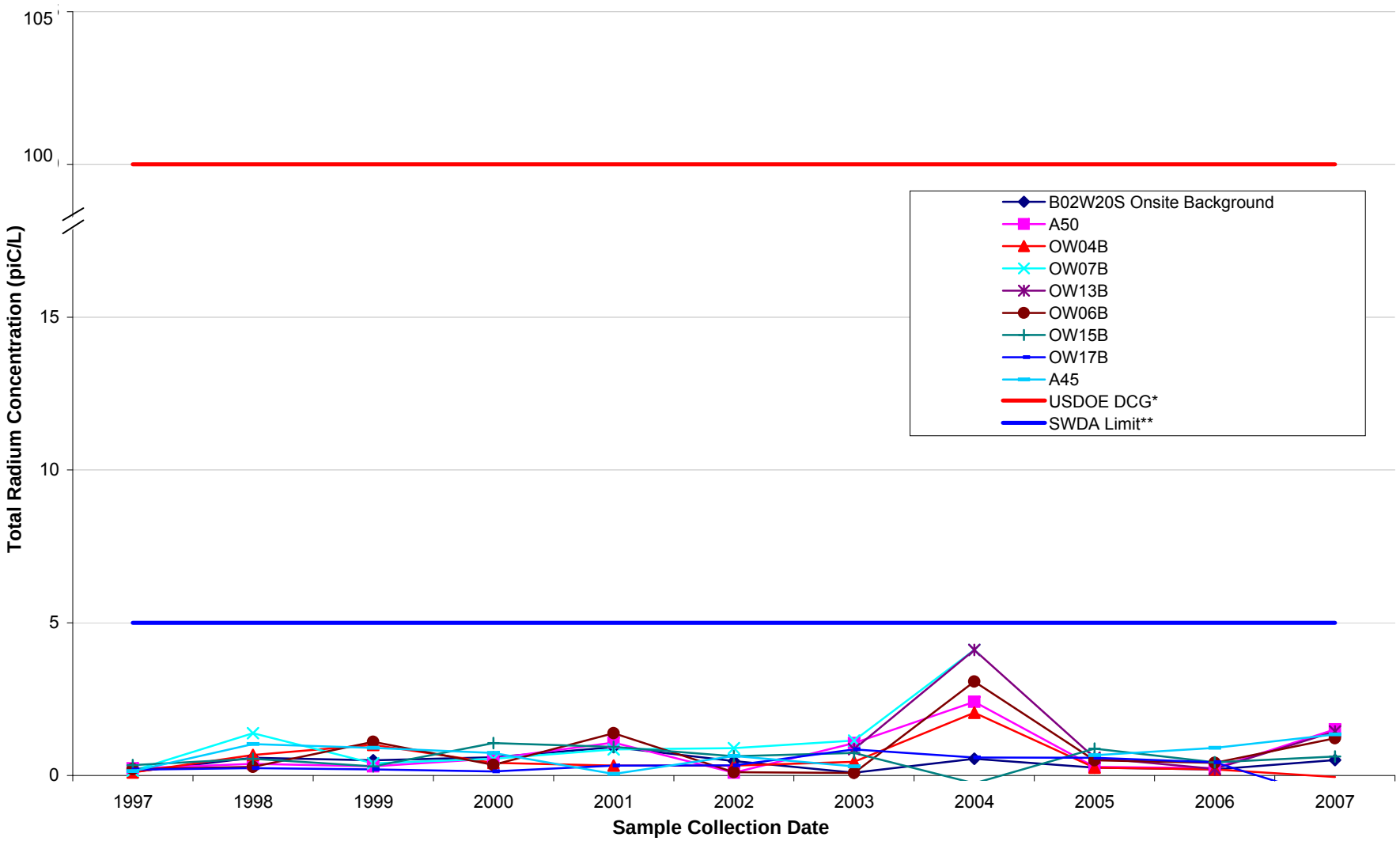
*The United States Department of Energy (USDOE) surface soil cleanup criterion for total thorium is 5pCi/g above background.

FIGURE 22: TOTAL URANIUM CONCENTRATION IN SEDIMENT



*The United States Department of Energy (USDOE) surface soil cleanup criterion for total uranium is 90pCi/g above background.

FIGURE 23: TOTAL RADIUM (RADIUM-226 AND RADIUM-228) CONCENTRATION IN GROUNDWATER AT NFSS

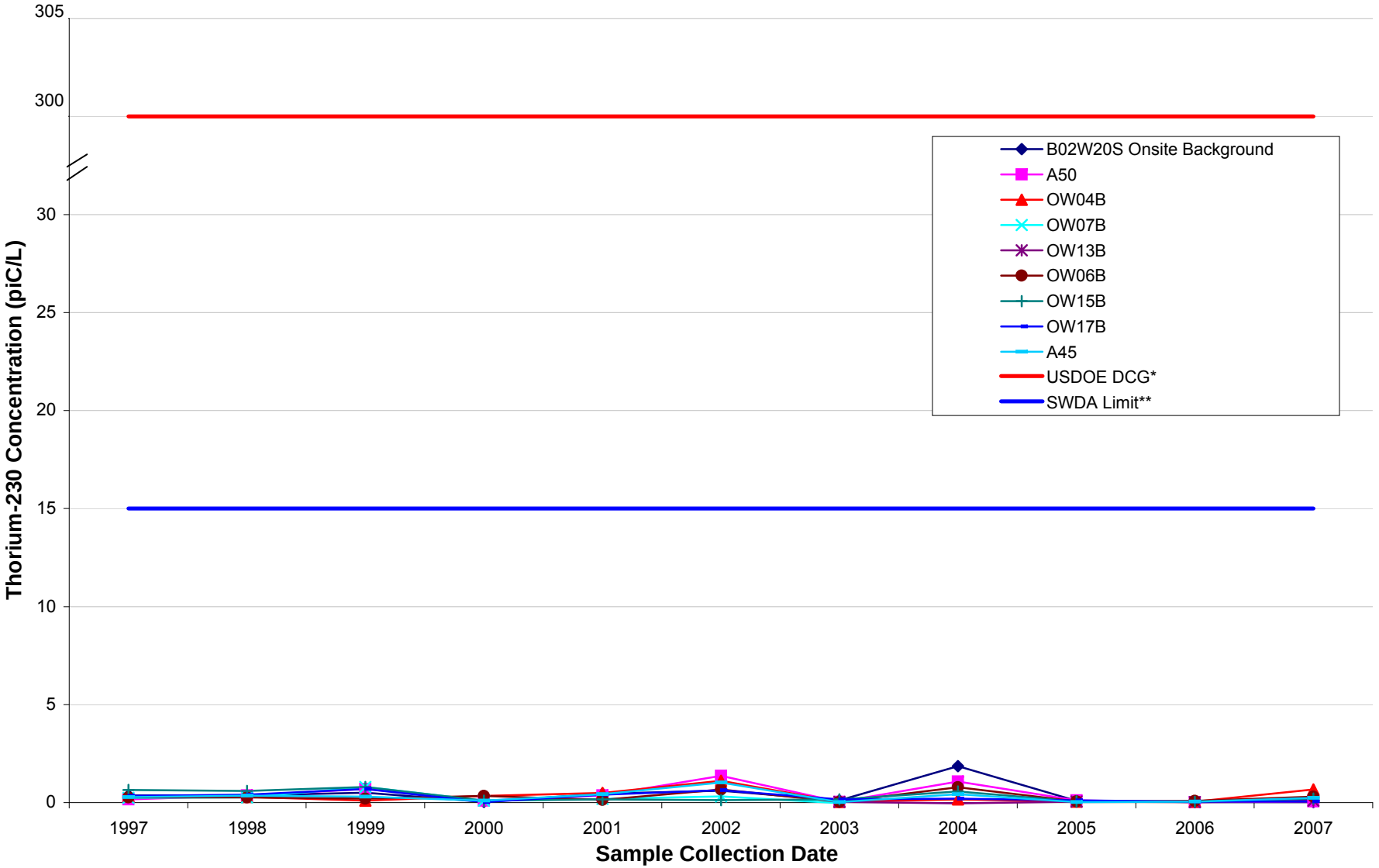


* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for combined Radium-226 & 228 is 100 pCi/L.

**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Total Radium is 5 pCi/L. Groundwater at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.

Note: Above combined radium values include both detect and non-detect values.

FIGURE 24: THORIUM-230 CONCENTRATION IN GROUNDWATER AT NFSS

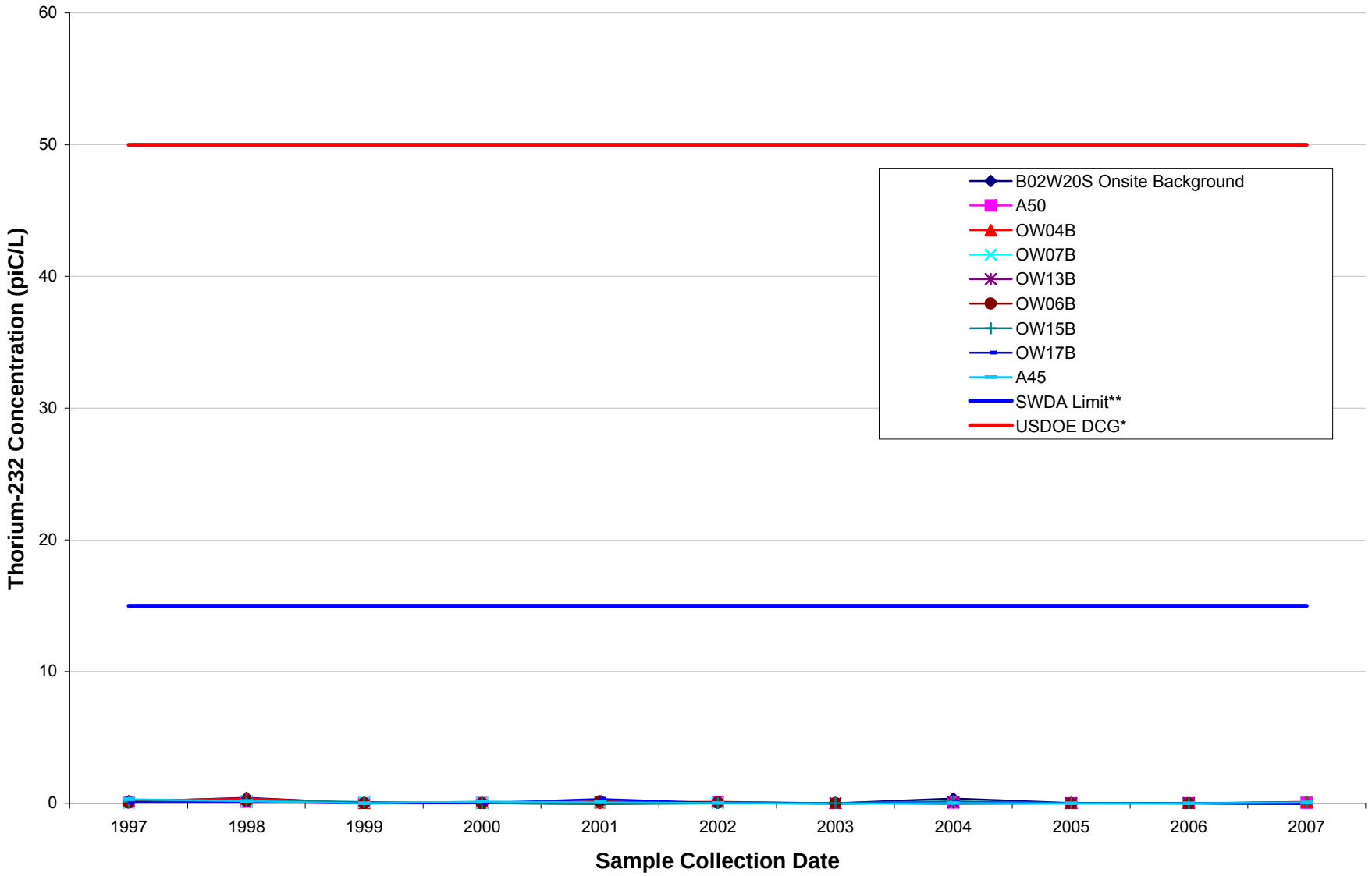


* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for Thorium-230 is 300 pCi/L.

**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Thorium-230 is 15 pCi/L. Groundwater at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.

Note: Above thorium-230 values contain detect and non-detect results.

FIGURE 25: THORIUM-232 CONCENTRATION IN GROUNDWATER AT NFSS

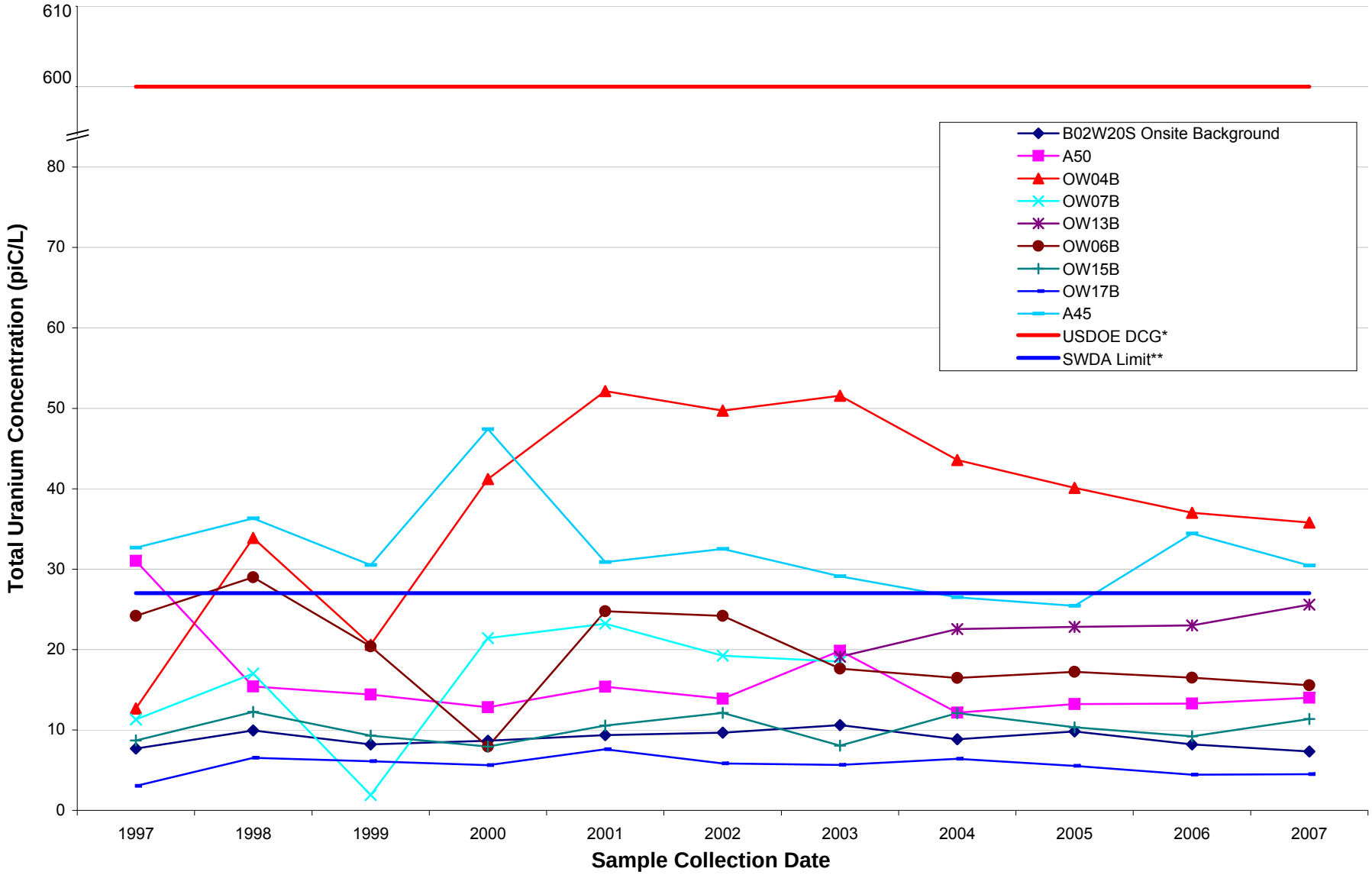


* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for Thorium-232 is 50 pCi/L.

**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Thorium-232 is 15 pCi/L. Groundwater at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.

Note: Above thorium-232 values contain detect and non-detect results.

FIGURE 26: TOTAL URANIUM CONCENTRATION IN GROUNDWATER AT NFSS



* The United States Department of Energy Derived Concentration Guide (USDOE DCG) for Total Uranium is 600 pCi/L.

**The Safe Drinking Water Act Maximum Containment Level (SDWA MCL) for Total Uranium is 27 pCi/L. Groundwater at NFSS is not a drinking water source. The above concentrations are for comparative purposes only.

APPENDIX B: NFSS CY2007 ENVIRONMENTAL SURVEILLANCE TECHNICAL MEMORANDUM

CY2007 CALCULATION OF EXTERNAL GAMMA RADIATION DOSE RATES FOR NIAGARA FALLS STORAGE SITE (NFSS)

LEWISTON, NEW YORK

June 2008

U.S. Army Corps of Engineers
Buffalo District Office
Formerly Utilized Sites Remedial Action Program

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1.0 PURPOSE

This calculation estimates the external gamma radiation dose from the Niagara Falls Storage Site (NFSS), Lewiston, New York (see Figure 1, Appendix A), during calendar year 2007 (CY2007). Hypothetical doses from external gamma radiation to members of the public are calculated from dose measurements using thermoluminescent dosimeters (TLDs) located at the perimeters of the NFSS and the Interim Waste Containment Structure (IWCS) (see Figure 2, Appendix A).

2.0 ASSUMPTIONS

Doses were calculated for off-site receptors based on these locations for off-site receptors based on the canvas of receptors in CY2007. The hypothetical doses for the nearest resident and off-site worker are reported. The modeling approach described below is considered to be protective of human health (conservative) in calculating hypothetical dose to receptors. The shielding effect of the air has not been included in the calculations. Calculations for the hypothetical annual external gamma radiation doses to the nearest resident and nearest off-site worker used the following assumptions:

Distance from each TLD above the source (the ground) is 3 feet (ft),
Distance from the TLDs to the nearest resident is 500 ft (perpendicular to the western TLD line),
Distance from the TLDs to the nearest off-site worker is 1,020 ft (perpendicular to the eastern TLD line),
Length of the western TLD monitoring line (western perimeter fence) is 2,766 ft,
Length of the eastern TLD monitoring line (east of Campbell Street) is 2,700 ft.

3.0 TLD DATA

At NFSS, TLDs are used to measure gamma radiation from the site and from sources of background radiation. Natural sources of background radiation include cosmic radiation and terrestrial radiation sources. In the United States, the annual average (per capita) cosmic and terrestrial radiation doses are 27 millirem per year (mrem/yr) and 28 mrem/yr, respectively (NCRP Report 93). Annual doses due to background at NFSS are measured at background locations using TLDs. Background dose for the same period of exposure is subtracted from site dose values to estimate the net dose from NFSS. TLDs are located at the facility perimeter and at the perimeter of the IWCS. The TLDs are placed at approximately 3 ft [1.6 meters (m)] above the ground surface. The TLDs measure approximately six-month intervals and are analyzed at an off-site vendor.

Eleven locations around the perimeter of the site and six locations around the IWCS were monitored in CY2007 (see Figure 2, Appendix A). In addition to these locations, there were three background locations (Figure 1, Appendix A). Two environmental TLDs were placed at each monitoring location. The environmental program utilizes two TLDs at each monitoring location for each monitoring period as a quality control check. In addition, if a measurement result is rejected or a TLD is lost, the duplicate reading is assumed for that monitoring period. In the first monitoring period of CY2007 however two TLDs were reported missing at location 12. An average value for the NFSS perimeter TLDs for the CY2007 first period was calculated and assigned to location 12.

TLD monitoring data for CY2007 are presented in Table 2 in the Tables section. A time-weighted or normalized annual dose is calculated that accounts for exposure periods having different integration times (a different number of measurement days). Negative net values, when they occur, are retained for calculation purposes.

4.0 ASSESSMENT METHODOLOGY AND RESULTS

Gamma radiation measured at the perimeter fence line represents the dose for full-time occupancy i.e. 24 hours/day and 365 days/year (366 days for a leap year). Dose to an off-site receptor is significantly affected by proximity to the source and the amount of time spent at the receptor location. The estimate of dose to an off-site worker therefore uses a correction factor for occupancy assuming 2000 hours worked per year. The estimate of dose to an off-site resident assumes a full-time occupancy at home. The average net dose rate for CY 2007 at the site perimeter by direction is calculated to be:

Direction	TLD Locations	Calculated Average Net Dose Rate (mrem/year)
North Perimeter	1, 11, 12, and 122	4.69
East Perimeter	1,28,123	5.37
South Perimeter	7, 28, and 29	5.16
West Perimeter	11,13,15,29,36,8,10	1.28

4.1 NEAREST RESIDENT

The dose calculation for the nearest resident uses the line of TLDs along the western perimeter fence. The TLDs along this side of the facility include NFSS perimeter fence monitoring locations 11, 13, 15, 29, and 36, and WCS perimeter fence monitoring locations 8 and 10. The two WCS locations are located close to the western NFSS perimeter fence. These TLD locations are shown in Appendix A, Figure 2. Net dose rates (corrected for background) for these TLDs are summed and divided by the total number of observations (14 for CY2007). This average value represents the annual dose at the site perimeter (D1 = 1.28 mrem for CY2007). The dose contribution to this resident from the southern exposure is insignificant compared to the exposure from the western line source. The western site perimeter dose is then used in the following equation for a line source:

$$D_2 = D_1 * h_1/h_2 * (\text{Arc Tan } (L/h_2) / \text{Arc Tan } (L/h_1))$$

where:
- D_2 = dose calculated at the receptor location from the line source
- D_1 = dose at the site perimeter as described above
- h_1 = the distance of the TLDs from the source (3 ft)
- h_2 = the distance of the resident from the fence line (500 ft)
- L = half the length of line of TLDs measuring the line source (1,383 ft)

Nearest Resident Dose Calculation (Resident southwest of NFSS)

NFSS Perimeter Monitoring Locations 11, 13, 15, 29, and 36 and IWCS Perimeter Monitoring Locations 8 and 10

where:
- h_1 = 3 feet distance of TLD from the source
- h_2 = 500 feet distance of resident from the TLDs
- L = 1,383 feet half the length of the western line source
- D_1 = 1.28 mrem average annual dose at the TLD monitoring locations
- D_2 = 0.006 mrem resident annual dose at 500 feet from the TLD

The hypothetical dose to the nearest resident is 6.0 E-03 (or 0.006) mrem for calendar year 2007.

4.2 NEAREST OFF-SITE WORKER

The dose to the nearest off-site worker uses, the line of TLDs, closest to the eastern perimeter fence (Castle Garden Road). The TLDs used include monitoring locations 1, 28, and 123. These TLDs are located along an interior fence east of Campbell Street. Their locations are shown in Figure 2, Appendix A. There are no WCS perimeter fence monitoring locations close to those along the line east of Campbell Street; therefore, none are included in the dose calculations. Net dose rates (corrected for background) for TLD monitoring locations 1, 28, and 123 are summed and divided by the total number observations (6 for CY2007). This average represents the annual dose at the site perimeter (D1 = 5.37 mrem for CY2007).

Nearest Off-Site Worker Dose Calculations (Worker east of NFSS)

NFSS Perimeter Monitoring Locations 1, 28, 123
h_1 = 3 feet distance of TLD from the source
h_2 = 1,020 feet distance of off-site worker from the TLDs
L = 1,350 feet half the length of the eastern line source
D_1 = 5.37 mrem average annual dose at the TLD monitoring locations
D_2 = 0.002 mrem off-site worker annual dose at 1,020 feet from the TLD location

Using the equation above) and a correction factor for off-site worker occupancy of 2000/8760 hours the hypothetical dose to the nearest off-site worker is 2.0 E-03 (or 0.002) mrem for calendar year 2007.

5.0 REFERENCES

Bechtel National, Inc. (BNI), 1997. "1996 Public External Gamma Dose," 14501-158-CV-031, Rev. 0, Oak Ridge, TN.

APPENDIX C: NFSS CY2007 ENVIRONMENTAL SURVEILLANCE TECHNICAL MEMORANDUM

FUSRAP CY2007 NESHAP ANNUAL REPORT FOR NIAGARA FALLS STORAGE SITE (NFSS)

LEWISTON, NEW YORK

JUNE 2008

U.S. Army Corps of Engineers
Buffalo District Office
Formerly Utilized Sites Remedial Action Program

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ACRONYMS AND ABBREVIATIONS

BNI	Bechtel National, Inc.
CAP88-PC Ver 3	Clean Air Act Assessment Package-1988, Version 3.0
CFR	Code of Federal Regulations
E_w	annual wind erosion emission
FUSRAP	Formerly Utilized Sites Remedial Action Program
ICRP	International Commission on Radiological Protection
IWCS	Interim Waste Containment Structure
m^2	square meter(s)
MEI	maximally exposed individual
ML	Modern Landfill
mph	miles per hour
NOAA	National Oceanic and Atmospheric Administration
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFIA	Niagara Falls International Airport
NFSS	Niagara Falls Storage Site
USAEC	United States Atomic Energy Commission
USACE	United States Army Corps of Engineers
UCL	upper confidence limit
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

In 1974, the United States Atomic Energy Commission (USAEC), a predecessor to the United States Department of Energy (USDOE), instituted the Formerly Utilized Sites Remedial Action Program (FUSRAP). This program is now managed by United States Army Corps of Engineers (USACE) to identify and clean up, or otherwise control sites where residual radioactivity remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized USACE to remedy under FUSRAP. The Niagara Falls Storage Site (NFSS) is a federally-owned storage site managed under FUSRAP. In October 1997, Congress transferred the responsibility for FUSRAP from USDOE to USACE.

1.1 SITE DESCRIPTION

The Niagara Falls Storage Site (NFSS) is located in the Town of Lewiston in northwestern New York State, northeast of Niagara Falls and south of Lake Ontario (Figure 1-Appendix A). NFSS is approximately 77 hectare (~191 acre) site which includes: one former process building (Building 401), one office building (Building 429), an equipment shed, and a 4 hectare (9.9 acre) interim waste containment structure (IWCS). The property is fenced, and public access is restricted.

Land use in the region is primarily rural; however, the site is bordered by a chemical waste disposal facility on the north, a solid waste disposal facility on the east and south, and a Niagara Mohawk Power Corporation right-of-way on the west. The nearest residential areas are approximately 1.1-km southwest of the site; the residences are primarily single-family dwellings.

1.2 SOURCE DESCRIPTION

Beginning in 1944, NFSS was used as a storage facility for radioactive residues and wastes. The residues and wastes are the process by-products of uranium extraction from pitchblende (uranium ore). Waste was also generated from remediation of buildings and process equipment used in the uranium extraction process. The residues originated at other sites and were transferred to NFSS for storage in buildings, on-site pits, and surface piles. Table 1 includes a brief history and description of the major radioactive residues and wastes transferred to NFSS. From 1953 to 1959 and 1965 to 1971, Building 401 was used as a boron-10 isotope separation plant.

Table 1. History and Description of Wastes Transferred to NFSS

Material	Description	Transferred to NFSS
L-50	Low-activity radioactive residues from the processing of low-grade uranium ores at Linde Air Products, Tonawanda, New York.	1944
R-10	Low-activity radioactive residues from the processing of low-grade uranium ores at Linde Air Products, Tonawanda, New York.	1944
F-32	Low-activity radioactive residues from the processing of high-grade uranium ores at Middlesex, New Jersey.	1944 to early 1950
L-30	Low-activity radioactive residues from the processing of low-grade uranium ores at Linde Air Products, Tonawanda, New York.	1945
K-65	High-activity radioactive residues from the processing of high-grade uranium ores at Mallinckrodt Chemical Works, St. Louis, Missouri.	1949
Middlesex Sands	Sand and abraded material from the sandblasting of buildings and process equipment where the F-32 residue was generated at Middlesex Metal Refinement Plant, Middlesex, New Jersey.	1950

Since 1971, activities at NFSS have been confined to residue and waste storage and remediation. All on-site and off-site areas with residual radioactivity exceeding USDOE guidelines were remediated between 1981 and 1992. The materials generated during remedial actions (approximately 195,000 m^3) are encapsulated in the IWCS (See Appendix A, Figure 2), which is specifically designed to provide interim storage of the materials. Remedial investigation began at the end of 1999 to determine if any areas of the site contained radioactive or chemical contaminants at levels that could pose an unacceptable risk to human health and the environment. Initial results show that isolated areas of elevated activity do exist.

2.0 REGULATORY STANDARDS

The United States Environmental Protection Agency's (USEPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) are compliance standards that require annual reporting of emissions of radionuclides and radon gas from operations at nuclear facilities.

2.1 40 CFR 61, SUBPART H

40 CFR 61, Subpart H provides standards for reporting emissions of radionuclides (excluding radon-222 and radon-220) into the air from USDOE facilities. Although control and maintenance of the site currently rests with USACE, responsibility for NFSS will return to USDOE following completion of remedial actions. This regulation therefore provides an appropriate standard for NFSS. Compliance with Subpart H is verified by applying the USEPA approved code, CAP88-PC. CAP88-PC Version 3.0 (USEPA 2006)] was used for this year's calculation. The applicable regulation, 40 CFR 61.92 limits exposure of the public to an annual effective dose equivalent of 10 mrem from radioactive emissions.

2.2 40 CFR 61, SUBPART Q

40 CFR 61, Subpart Q applies to storage and disposal facilities for radium-containing material that emits radon-222 into air. NFSS is specifically identified as one such facility in this subpart (in 40 CFR 61.190). Compliance with Subpart Q is verified by annual monitoring of the IWCS for radon-222 flux. Subpart Q limits radon-222 emission to 20 $pCi/m^2/s$.

3.0 AIR EMISSION DATA

Table 2 summarizes the sources of air emissions. Attachment A contains the annual wind erosion emission (E_w) calculation. Attachment B contains the radioactive source term calculations and annual air releases.

These calculations use the USEPA air pollution emission factor methodology (AP-42) to estimate the radioactive release from wind erosion, which is then used as the source term in the Clean Air Act Assessment Package (CAP88-PC) model to estimate airborne doses to hypothetically exposed individuals. The annual wind erosion emission estimate uses the most current soil data from the NFSS RI sampling Phases I, II, and III. A 95% upper confidence limit (UCL) without the subtraction of background radioactivity, was calculated for each soil nuclide of concern and used for the 2007 year source term estimate. The area of the entire NFSS was assumed to be uniformly contaminated and to contribute to the source term.

Table 2. Air Emission Data - NFSS

Point Sources	Type Control	Efficiency	Distance to Hypothetical Exposed Individual
none	not applicable	not applicable	not applicable
Non-Point Sources	**Type Control**	**Efficiency**	**Distance and Direction from Center of Site to Hypothetical Exposed Individual**
in situ soil –area source	vegetative cover	90 percent[a]	533 m SE Modern Scale-house Worker 783 m S Greenhouse Worker 914 m SSW Resident 1105 m S Resident (farm) 1250 m WSW Resident 1486 m ESE Resident 2499 m W School 2629 m WNW School
Group Sources	**Type Control**	**Efficiency**	**Distance to Hypothetical Exposed Individual**
none	not applicable	not applicable	not applicable

[a] This is the fraction of vegetative cover used to correct emissions (Attachments A,B).

4.0 DOSE ASSESSMENTS

4.1 MODEL SOURCE DESCRIPTION

To determine the dose from airborne particulates potentially released from NFSS during CY2007, the annual wind erosion emission, E_w (Attachment A) is calculated using local climatological data (Attachment F) from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center for the Niagara Falls International Airport (NFIA) in Niagara Falls, NY. The complete "Annual Climatological Data" report from NOAA was not available for this year. At the time of the writing this report data is missing for the month of September. Therefore the Northeast Regional Climate Center at Cornell University provided annual data for average temperature and total precipitation for Niagara Falls Airport. Data from an on-site meteorological station at Modern Landfill (ML) in Lewiston, NY was not used this year. E_w is calculated using the USEPA AP-42 methodology for "fugitive emissions" from an "area source" that uses the "fastest mile" wind speed data from local climatological data reports. E_w, in grams emitted, is then applied to the soil nuclide concentration to estimate the source term or annual emissions for each radionuclide. The soil concentration was developed from sample data compiled during Phases I, II, and III of the Remedial Investigation for soil contamination (Attachment B). Contributions from radon gas, in accordance with regulatory guidance, are not considered in this calculation. Annual estimated emissions for each radionuclide were input into the USEPA's CAP88-PC, Version 3.0 code to calculate hypothetical receptor doses. The model estimates resultant doses from airborne particulates to hypothetical individuals at the distances to the nearest residence, commercial/industrial facility, school, and farm as measured from a central location on-site. Hypothetical doses are then corrected for occupancy. Commercial/industrial facility and school occupancy is assumed to be 40 hr/week for 50 weeks/yr). Residential and farm occupancy is assumed to be full-time for 24 hr/day for 365 days/yr. The hypothetical individual receiving the higher of these calculated doses is then identified as the maximally exposed individual (MEI) for airborne particulate dose.

4.2 DESCRIPTION OF DOSE MODEL

4.2.1 CAP88-PC Computer Program

The CAP88-PC model is a set of computer programs, databases, and associated utility programs that estimate the dose and risk from airborne radioactivity emissions. The USEPA NESHAP compliance procedures for airborne radioactivity emissions at USDOE facilities (40 CFR 61.93(a)) require the use of the CAP88-PC model, or other approved procedures to calculate effective dose equivalents to members of the public.

CAP88-PC uses a modified Gaussian plume equation to estimate the average dispersion of radionuclides released from a site. Assessments are performed for a circular grid of distances and directions for a radius of 80 km (50 miles) around the facility. Agricultural arrays of milk cattle, beef cattle and agricultural crop area are generated automatically, requiring the user to supply only the State name or agricultural productivity values. Dose and risk factors for CAP88-PC, Version 3.0 are from Federal Guidance Report 13 and are based on the methods detailed in International Commission on Radiological Protection (ICRP) 72 (ICRP72) The dose calculations presented in this document used the default values for nuclide lung clearance type. These defaults correspond to the recommended values from FGR 13. Deposition velocity and scavenging coefficient are calculated by the code in accordance with USEPA policy. In the CAP88 model nuclides are depleted from the plume by precipitation scavenging, dry deposition and radioactive decay. The default scavenging coefficient is calculated as a function of annual precipitation. The program calculates the effective dose equivalents received by receptors by combining the inhalation and ingestion intake rates and the air and ground surface concentrations using the appropriate dose conversion factors.

4.2.2 CAP88-PC Input

Input parameters for CAP88 include:

Radionuclide emissions (Attachment B),
Weather data (average annual temperature, total annual precipitation) (Attachment F),
Emission source height and area (Section 4.3), and
Distance to nearest resident, off-site worker, school, and farm (Section 4.3).

4.2.3 CAP88-PC Output

The "Dose and Risk Equivalent Summaries" from CAP88-PC contains the resulting effective dose equivalents for each modeled scenario. The effective dose equivalent summary contains results for 16 compass directions around the facility for the nearest resident, off-site worker, school, and farm. CY2007 CAP88-PC individual receptor and population output summaries are located in Attachment C and D, respectively.

4.3 COMPLIANCE ASSESSMENT

The released activity data from Attachment B is entered into the CAP88-PC modeling program to derive the hypothetical dose to the defined receptors. To derive the dose to the MEI, the CAP88-PC model must have weather data for the appropriate year, information on the emission source, and the distances and directions to the nearest residence, off-site worker,

school, and farm. The following CY2007 meteorological data were entered into CAP88-PC (see Attachment E):

Average temperature	9.0 °C (48.3 °F) NFIA,
Precipitation,	74.2 cm (29.21 inches) ML, and
Mixing height	1,000 m

The following emission source and nearest receptor distances and direction information were also entered into the program:

Source height	0 m,
Source area	780,000 m^2,
Resident	914 m SSW
Resident (farm)	1105 m S
Resident	1250 m WSW
Resident	1486 m ESE,
Off-site worker	533 m SE,
Off-site worker	783 m S
School (building)	2499 m W
School(building)	2629 m WNW

The CAP88-PC annual hypothetical dose to the nearest resident, off-site worker, school, and farm at the corresponding directions and distances taken from page six of the "Dose and Risk Equivalent Summaries" document for individual modeling (Attachment C) are:

Resident	8.4 E-04 mrem, SSW @ 914 m,
Off-site worker	3.6 E-03 mrem, SE @ 533 m
School	3.3 E-04 mrem, W @ 2499 m and
Farm	6.4 E-04 mrem, S @ 1105 m.

The hypothetical doses to the nearest off-site worker and school corrected for 2,000 hr of exposure per year are:

Off-site worker	8.2 E-04 mrem and
School	7.5 E-05 mrem.

5.0 SUPPLEMENTAL INFORMATION

5.1 POPULATION DOSE

The CAP88-PC model was also used to estimate the hypothetical airborne particulate dose to the population within 80 km of the site. Population data taken from year 2000 census data for New York State and 2001 census data for Ontario, Canada was used to create a population file for CAP88-PC. The effective dose equivalent for the collective population in person-rem/yr is from the CAP88-PC "Dose and Risk Equivalent Summaries" report.

The CAP88-PC annual effective dose for the population within 80 km of the facility (Attachment D) is:

Population:	2.6 E-02 person-rem

5.2 RADON-222 FLUX

Measurement of radon-222 flux provides an indication of the rate of radon-222 emission from a surface. Radon-222 flux is measured with activated charcoal canisters placed at 15-m

intervals across the surface of the IWCS for a 24-hr exposure period. Measurements for CY2007 are presented in Table 4; measurement locations are shown in Appendix A, Figure 2.

Measured results for 2007 ranged from non-detect to 0.06571pCi/m^2/s, with an average (of detects and non-detects) result of 0.02974 pCi/m^2/s. As in previous years, these results are well below the 20 pCi/m^2/s standard specified in 40 CFR Part 61, Subpart Q, and demonstrate the effectiveness of the containment cell design and construction in mitigating radon-222 migration.

5.3 NON-APPLICABILITY

Requirements from section 61.93(b) of 40 CFR for continuous monitoring from point sources (stacks or vents) are not applicable to NFSS.

6.0 REFERENCES

ANL 2003. CAP88-PC Population Files for NFSS, Argonne National Laboratory, Chicago, Illinois.

Bechtel National, Inc. (BNI), 1997. "1996 Public Inhalation Dose" 14501-158-CV-030, Rev. 0, Oak Ridge, TN.

Environmental Protection Agency (EPA), 1995. *Compilation of Air Pollutant Emission Factors, Fifth Edition*, AP-42, Office of Air Quality Planning and Standards, Research Triangle Park, NC (January).

Environmental Protection Agency (EPA), 2006. CAP88-PC Version 3.0 Computer Code, U.S. Environmental Protection Agency.
Environmental Protection Agency (EPA), 1999. *Federal Giudance Report 13, Cancer Risk Coefficients for Environmental Exposure to Radionuclides,* EPA99 EPA 402-R-99_001, USEPA Office of Radiation and Indoopr Air, Washington, DC.

International Commission on Radiological Protection (ICRP72), 1996. *Age Dependent Doses to Members of the Public from Intake of Radionuclides, Part 5, Compilation of Ingestion and Inhalation Dose Coefficients*," ICRP 72, Pergamon Press, Oxford.

40 CFR 61, Subpart H. *National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities.*

40 CFR 61, Subpart Q. *National Emission Standards for Radon Emissions from Department of Energy Facilities.*

ATTACHMENT A

ANNUAL WIND EROSION EMISSION CALCULATION

A.1 ANNUAL WIND EROSION

In 2007, the potential source of airborne emissions from NFSS is assumed to be from wind erosion of in-situ soil from the entire NFSS. The AP-42 model for industrial wind erosion for limited flat sources is used. In this model the potential airborne emissions are a function of the number of disturbances of contaminated soil. The following assumptions and calculations are made:

The air release source is wind erosion of in-situ soil from an area (A) of 780,000 m^2 of vegetation covered soil.

$A = 780{,}000\ m^2$

The calculation assumes that 90% of this area is covered by grass or vegetation (V).

$V = 0.90$

For CY 2007 there is assumed to have been weekly grass cutting for half the year, occurring May through October and an April spring thaw. The number of estimated disturbances (N) is therefore:

$N = 27$

The threshold velocity (U_t) for overburden (USEPA 1995 Table 13.2.5-2) is:

$U_t = 1.02$ m/s

Anemometer height adjustment is not necessary.

Z_r = reference anemometer height = 10 m

Z_a = actual anemometer height = 10 m

The roughness height for overburden is 0.3 cm (USEPA 1995 Table 13.2.5-2).

$Z_o = 0.3$ cm

The corrected wind speed (U_{rN}) for each period (N) between disturbances (USEPA 1995 Equation 5) is:

$U_{rN} = U_{aN}\ [\ln(Z_{r/}\ Z_o) / \ln(Z_{a/}\ Z_o)]$, therefore $U_{rN} = U_{aN}$

The equivalent friction velocity (U_N) for each period between disturbances (USEPA 1995 Equation 4) is:

$U_N = 0.053\ U_{rN}$

The fastest mile speeds (maximum 2-minute wind speeds[a]) from Local Climatological Data reports from NOAA for Niagara Falls International Airport (NFIA) in mph for the period between each disturbance are:

$U_{a1} = 37$	$U_{a2} = 22$	$U_{a3} = 21$	$U_{a4} = 31$	$U_{a5} = 29$	$U_{a6} = 23$
$U_{a7} = 43$	$U_{a8} = 22$	$U_{a9} = 51$	$U_{a10} = 26$	$U_{a11} = 24$	$U_{a12} = 30$
$U_{a13} = 35$	$U_{a14} = 18$	$U_{a15} = 38$	$U_{a16} = 22$	$U_{a17} = 32$	$U_{a18} = 32$
$U_{a19} = 20$	$U_{a20} = 32$	$U_{a21} = 43$	$U_{a22} = 24$	$U_{a23} = 28$	$U_{a24} = 28$
$U_{a25} = 26$	$U_{a26} = 29$	$U_{a27} = 33$			

[a]Maximum 2-minute wind speeds can be used to approximate fastest mile wind speeds (USEPA 2004 Table 7-4), however, this calculation applies an uncertainty correction factor, protective of human health, of 1.3 in order to approximate the fastest mile wind speeds.

The equivalent friction velocity in m/s for each period is:

U_1 = 1.14 E00	U_2 = 6.78 E-01	U_3 = 6.47 E-01	U_4 = 9.55 E-01	U_5 = 8.93 E-01	U_6 = 7.08 E-01
U_7 = 1.32 E00	U_8 = 6.78 E-01	U_9 = 1.57 E00	U_{10} = 8.01 E-01	U_{11} = 7.39 E-01	U_{12} = 9.24 E-01
U_{13} = 1.08 E00	U_{14} = 5.54 E-01	U_{15} = 1.17 E00	U_{16} = 6.78 E-01	U_{17} = 9.86 E-01	U_{18} = 9.86 E-01
U_{19} = 6.16 E-01	U_{20} = 9.86 E-01	U_{21} = 1.32 E00	U_{22} = 7.39 E-01	U_{23} = 8.62 E-01	U_{24} = 8.62 E-01
U_{25} = 8.01 E00	U_{26} = 8.93 E-01	U_{27} = 1.02 E00			

The erosion potential (P_N) for a dry exposed surface (USEPA 1985 Figure 4-2) is:

$$P_N = 58 (U^*-U_t)^2 + 25(U^*-U_t) = 23.53 \text{ g/m}^2$$

The erosion potentials (P_N) for each period between disturbances in CY 2007 are all less than or equal to the threshold friction velocity except for U_1, U_7, U_9, U_{13}, U_{15}, and U_{21}.

The particle size multiplier (k) for 10 μ particles (USEPA 1995 Equation 2) is:

$$k = 0.5$$

The emission factor (P) for dry bare soil for 10 μ particles (USEPA 1995 Equation 2) is:

$$P = k \sum P_N = \text{is } 6.66 \text{ g/m}^2$$

Thornthwaite's Precipitation Evaporation Index (PE), used as a measure of average soil moisture, is:

$$PE = 110$$

The corrected emission factor (PM_{10}) for 10 μ particles (USEPA 1985 Equation 4-1) is:

$$PM_{10} = P(1-V) / (PE/50)^2 = 0.24 \text{ g/m}^2\text{/yr}$$

The annual wind erosion emission (E) is calculated to be:

$$E = A (PM_{10}) = 189{,}586 \text{ g soil}$$

A.2 REFERENCES

EPA 2004. *Methods for Estimating Fugitive Air Emissions of Radionuclides from Diffuse Sources at USDOE Facilities*, Final Report, September 3, 2004.

EPA 1995. *AP 42 Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, Fifth Edition, 1995.

M. J. Changery, *National Wind Data Index Final Report*, HCO/T1041-01 UC-60, National Climatic Center, Asheville, NC, December 1978.

EPA 1985. *Rapid Assessment of Exposure to Particulate Emissions from Surface Contaminated Sites*, EPA/600/8-85/002, Office of Health and Environmental Assessment, Washington, DC (February).

EPA 1985. *AP 42 Compilation of Air Pollution Emission Factors*, Third Edition (including supplements 1-7), August 1977.

ATTACHMENT B

SOURCE TERM DEVELOPMENTAND ANNUAL AIR EMISSIONS

B.1 SOURCE TERM DEVELOPMENT

The source term for NFSS NESHAPS calculations was developed considering the radionuclides in the uranium, thorium, and actinium decay series as shown in Table B-1. Concentration data for these radioisotopes were taken from Phases I, II, and III of the Remedial Investigation and are listed in Table B-2. The Phase I sampling was performed from November 1999 through January 2000. The Phase II was performed from August 2000 through October 2000. The Phase III sampling was performed from May 2001 through October 2003. The dataset has been verified to ensure data quality and includes the analysis of soils from biased high locations (i.e., locations that had elevated gamma survey readings). The dataset used for CY 2007 uses higher soil concentrations than in years before CY2004 and more conservatively estimates (biased high) the site concentration values.

The IWCS, completed in 1986 and added to in 1991, is surrounded by sufficient topsoil and compacted clay to consider radionuclide emissions negligible. In 1986, the entire IWCS was covered with 0.9 meters (3 feet) of low-permeability, compacted clay, a 0.3 meter (12 inch)-thick layer of loosely compacted soil, 0.15 meter (6 inches) of topsoil and covered with shallow-rooted grass. A clay cutoff wall and dike measuring 3.35 to 8.84 meters (11 to 29 feet) in thickness formed the perimeter. In 1991 additional soil with residual radioactivity from a vicinity property, along with 60 drums containing radioactive material, were placed over the existing IWCS. Six inches of clay was placed over the waste material and two feet of compacted clay was added on top along with 0.46 meter (1.5 feet) of topsoil material. However, the area of the cap was included in the site area estimate.

Radium-226 was detected at an elevated concentration of 1,140 pCi/g in one area during the Phase I remedial investigation. This was analyzed and determined to come from a stone in the sample. Although release rates are based on dust erosion and not buried stones, this detection was used in the source term calculation.

Soil concentration data, listed in Table B-3, are not available for all the radionuclides in Table B-1. If explicit results for a radionuclide were not available, it was assumed that the radionuclide was present in equilibrium with (i.e., at the same concentration as) the nearest long-lived parent. Branching ratios were used to estimate source term concentrations. Table B-3 lists the source term values used in the CAP-88 modeled scenarios.

Table B-1. Radionuclides Considered in NESHAPS Evaluation

Uranium Series	Thorium Series	Actinium Series
U-238	Th-232	U-235
Th-234	Ra-228	Th-231
Pa-234m	Ac-228	Pa-231
Pa-234 (0.13%)	Th-228	Ac-227
U-234	Ra-224	Th-227 (98.62%)
Th-230	*Rn-220 (thoron)	Fr-223 (1.38%)
Ra-226	Po-216	Ra-223
*Rn-222 (radon)	Pb-212	*Rn-219 (actinon)
Po-218	Bi-212	Po-215
Pb-214 (99.98%)	Po-212 (64.07%)	Pb-211 (≈ 100%)
At-218 (0.02%)	Tl-208 (35.93%)	At-215 (0.00023%)
Bi-214	*Pb-208 (stable)	Bi-211
Po-214 (99.979%)		Po-211 (0.273%)
Tl-210 (0.021%)		Tl-207 (99.73%)
Pb-210		*Pb-207 (stable)
Bi-210		
Po-210 (≈ 100%)		
Tl-206 (0.00013%)		
*Pb-206 (stable)		

Nuclides with asterisks (*) were excluded from dose calculations for the following reasons: 1) Radon isotopes including thoron and actinon are specifically excluded per the regulation or 2) nuclides of low abundance and stable nuclides do not contribute significantly to radiological dose.

Nuclides are presented from top to bottom in order of decay starting from the parent radionuclides. Branching fractions are shown, as appropriate, for consideration in source term development. Fractions taken from Shleien, 1992.

Table B-2. Summary of Phases I, II, and III Characterization Data Used in NESHAP Dose Calculations

Analyte	Units	Results	Minimum Detect	Maximum Detect	Average Result	95% UCL of the Mean	Input Exposure Concentration
Radium-226 [a]	(pCi/g)	552	0.0607	1140	10.23	26.09	26.09
Thorium-228	(pCi/g)	552	0.0481	2.38	1.06	1.08	1.08
Thorium-230	(pCi/g)	552	0.0906	978	8.68	22.74	22.74
Thorium-232	(pCi/g)	551	0.0149	2.07	0.88	0.89	0.89
Uranium-234	(pCi/g)	552	0.0416	8340	20.57	87.4	87.4
Uranium-235	(pCi/g)	553	-0.16	886	1.94	8.97	8.97
Uranium-238	(pCi/g)	551	0.049	8830	21.59	92.38	92.38

[a] Includes previous outlier 1,140 pCi/g (NiagAir1 on 25JUL00 at 15:36 using dataset allradnq)

Table B-3. Soil Concentration and Estimated Emission of Radionuclides from NFSS for CY 2007

Soil Concentration and CAPP88 Input Source Term								
Uranium Series			Thorium Series			Actinium Series		
Nuclide	pCi/g	Ci/y	Nuclide	pCi/g	Ci/y	Nuclide	pCi/g	Ci/y
U-238	92.38	1.75E-05	Th-232	0.89	1.69E-07	U-235	8.97	1.70E-06
Th-234	92.38	1.75E-05	Ra-228	0.89	1.69E-07	Th-231	8.97	1.70E-06
Pa-234m	92.38	1.75E-05	Ac-228	0.89	1.69E-07	Pa-231	8.97	1.70E-06
Pa-234	92.38	2.28E-08	Th-228	1.08	2.05E-07	Ac-227	8.97	1.70E-06
U-234	87.4	1.66E-05	Ra-224	1.08	2.05E-07	Th-227	8.97	1.68E-06
Th-230	22.74	4.31E-06	Rn-220	1.08	0.00E-00	Fr-223	8.97	2.35E-08
Ra-226	26.09	4.95E-06	Po-216	1.08	2.05E-07	Ra-223	8.97	1.70E-06
Rn-222	26.09	0.00E-00	Pb-212	1.08	2.05E-07	Rn-219	8.97	0.00E-00
Po-218	26.09	4.95E-06	Bi-212	1.08	2.05E-07	Po-215	8.97	1.70E-06
Pb-214	26.09	4.95E-06	Po-212	1.08	1.31E-07	Pb-211	8.97	1.70E-06
At-218	26.09	9.89E-10	Tl-208	1.08	7.36E-08	At-215	8.97	3.91E-12
Bi-214	26.09	4.95E-06	Pb-208 (stable)	1.08	0.00E-00	Bi-211	8.97	1.70E-06
Po-214	26.09	4.95E-06				Po-211	8.97	4.64E-09
Tl-210	26.09	1.04E-09				Tl-207	8.97	1.70E-06
Pb-210	26.09	4.95E-06				Pb-207 (stable)	8.97	0.00E-00
Bi-210	26.09	4.95E-06						
Po-210	26.09	4.95E-06						
Tl-206	26.09	6.43E-12						
Pb-206 (stable)	26.09	0.00E-00						

B.2 REFERENCES

Shleien, 1992. *The Health Physics and Radiological Health Handbook,* Scinta, Inc., Silver Spring, MD.

ATTACHMENT C

CAPP88-PC REPORTS – INDIVIDUAL

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 30, 2008 10:24 am

Facility: Niagara Falls Storage Site
Address: 1397 Pletcher Road
City: Lewiston
State: NY Zip: 14174

Source Category: Area Source
Source Type: Area
Emission Year: 2007

Comments: Tech Memo 2007
Cap88V3

Dataset Name: NFSS 2007 Ind
Dataset Date: 5/30/2008 9:52:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WindLib\IAG0905.WND

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	9.49E-05
INHALATION	4.38E-03
AIR IMMERSION	1.60E-08
GROUND SURFACE	1.63E-04
INTERNAL	4.47E-03
EXTERNAL	1.63E-04
TOTAL	4.64E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
U-238	4.12E-04
Th-234	3.19E-06
Pa-234m	2.74E-05
Pa-234	1.36E-10
U-234	4.75E-04
Th-230	4.96E-04
Ra-226	1.65E-04
Rn-222	3.14E-15
Po-218	5.96E-10
Pb-214	1.70E-05
Bi-214	9.98E-05
Po-214	5.45E-09
Pb-210	7.26E-05
Bi-210	6.29E-06
Po-210	1.41E-04
At-218	0.00E+00
Th-232	3.40E-05
Ra-228	3.62E-06
Ac-228	1.66E-08
Th-228	6.61E-05
Ra-224	4.95E-06
Rn-220	1.20E-13
Po-216	5.05E-15
Pb-212	2.86E-07
Bi-212	5.14E-08
Po-212	0.00E+00
Tl-208	3.96E-10
U-235	4.67E-05
Th-231	3.89E-07
Pa-231	1.30E-03
Ac-227	1.01E-03
Th-227	1.44E-04
Ra-223	1.07E-04
Rn-219	1.42E-10
Po-215	4.09E-09
Pb-211	2.46E-06
Bi-211	1.07E-06
Tl-207	1.35E-06
Po-211	5.39E-14
Fr-223	1.99E-09
TOTAL	4.64E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	3.65E-12
Stomach	1.06E-11
Colon	3.08E-11
Liver	9.02E-11
LUNG	1.76E-09
Bone	5.97E-11
Skin	3.69E-12
Breast	9.71E-12
Ovary	1.22E-11
Bladder	8.68E-12
Kidneys	1.07E-11
Thyroid	8.58E-13
Leukemia	1.82E-11
Residual	4.02E-11
Total	2.06E-09
TOTAL	4.12E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.90E-11
INHALATION	1.96E-09
AIR IMMERSION	8.56E-15
GROUND SURFACE	7.45E-11
INTERNAL	1.98E-09
EXTERNAL	7.45E-11
TOTAL	2.06E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
U-238	3.40E-10
Th-234	2.28E-12
Pa-234m	4.38E-12
Pa-234	8.65E-17
U-234	3.93E-10
Th-230	2.54E-10
Ra-226	1.27E-10
Rn-222	1.71E-21
Po-218	3.27E-16
Pb-214	9.15E-12
Bi-214	5.30E-11
Po-214	2.99E-15
Pb-210	3.69E-11
Bi-210	3.57E-12
Po-210	1.15E-10
At-218	0.00E+00
Th-232	1.51E-11
Ra-228	1.73E-12
Ac-228	1.06E-14
Th-228	5.66E-11
Ra-224	4.26E-12
Rn-220	6.54E-20
Po-216	2.76E-21
Pb-212	2.46E-13
Bi-212	3.32E-14
Po-212	0.00E+00
Tl-208	2.19E-16
U-235	3.76E-11
Th-231	1.78E-13
Pa-231	1.23E-10
Ac-227	2.66E-10
Th-227	1.24E-10
Ra-223	9.08E-11
Rn-219	7.69E-17
Po-215	2.24E-15
Pb-211	8.97E-13
Bi-211	5.86E-13
Tl-207	1.72E-13
Po-211	2.95E-20
Fr-223	1.68E-15
TOTAL	2.06E-09

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	533	783	914	1105	1250	1486	2499
N	3.3E-03	1.4E-03	1.0E-03	7.7E-04	6.5E-04	5.2E-04	2.7E-04
NNW	2.6E-03	1.1E-03	7.6E-04	5.2E-04	4.2E-04	3.0E-04	1.3E-04
NW	2.6E-03	9.2E-04	7.0E-04	5.1E-04	4.3E-04	3.4E-04	1.8E-04
WNW	2.8E-03	1.4E-03	1.1E-03	7.5E-04	6.1E-04	4.6E-04	2.2E-04
W	3.1E-03	1.5E-03	1.2E-03	8.9E-04	7.5E-04	6.1E-04	3.3E-04
WSW	3.1E-03	1.5E-03	1.1E-03	7.9E-04	6.4E-04	4.8E-04	2.2E-04
SW	2.8E-03	1.1E-03	8.5E-04	6.3E-04	5.3E-04	4.1E-04	2.2E-04
SSW	2.6E-03	1.1E-03	8.4E-04	5.9E-04	4.8E-04	3.6E-04	1.7E-04
S	2.7E-03	1.1E-03	8.6E-04	6.4E-04	5.4E-04	4.3E-04	2.3E-04
SSE	3.1E-03	1.5E-03	1.1E-03	7.6E-04	6.1E-04	4.6E-04	2.1E-04
SE	3.6E-03	1.6E-03	1.2E-03	8.8E-04	7.4E-04	5.8E-04	3.0E-04
ESE	3.9E-03	1.8E-03	1.4E-03	9.7E-04	7.9E-04	6.0E-04	2.8E-04
E	4.4E-03	1.9E-03	1.4E-03	1.0E-03	8.4E-04	6.5E-04	3.2E-04
ENE	4.6E-03	2.2E-03	1.6E-03	1.1E-03	9.3E-04	6.9E-04	3.0E-04
NE	4.6E-03	2.2E-03	1.7E-03	1.2E-03	1.0E-03	8.1E-04	4.1E-04
NNE	4.1E-03	2.1E-03	1.5E-03	1.1E-03	8.8E-04	6.6E-04	3.0E-04

	Distance (m)
Direction	2629
N	2.6E-04
NNW	1.3E-04
NW	1.7E-04
WNW	2.0E-04
W	3.1E-04
WSW	2.1E-04
SW	2.1E-04
SSW	1.6E-04
S	2.2E-04
SSE	2.0E-04
SE	2.8E-04
ESE	2.6E-04
E	3.0E-04
ENE	2.8E-04
NE	3.9E-04
NNE	2.8E-04

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Distance (m)

Direction	533	783	914	1105	1250	1486	2499
N	1.5E-09	6.0E-10	4.5E-10	3.4E-10	2.8E-10	2.2E-10	1.1E-10
NNW	1.2E-09	4.6E-10	3.3E-10	2.2E-10	1.8E-10	1.3E-10	5.0E-11
NW	1.2E-09	4.0E-10	3.0E-10	2.2E-10	1.8E-10	1.4E-10	7.2E-11
WNW	1.3E-09	6.3E-10	4.6E-10	3.2E-10	2.6E-10	1.9E-10	8.6E-11
W	1.4E-09	6.7E-10	5.2E-10	3.9E-10	3.3E-10	2.6E-10	1.4E-10
WSW	1.4E-09	6.7E-10	4.9E-10	3.4E-10	2.8E-10	2.0E-10	8.8E-11
SW	1.3E-09	4.9E-10	3.7E-10	2.7E-10	2.2E-10	1.8E-10	8.8E-11
SSW	1.1E-09	5.0E-10	3.6E-10	2.5E-10	2.0E-10	1.5E-10	6.5E-11
S	1.2E-09	4.9E-10	3.8E-10	2.8E-10	2.3E-10	1.8E-10	9.3E-11
SSE	1.4E-09	6.4E-10	4.7E-10	3.3E-10	2.6E-10	2.0E-10	8.5E-11
SE	1.6E-09	7.0E-10	5.3E-10	3.8E-10	3.2E-10	2.5E-10	1.2E-10
ESE	1.7E-09	8.1E-10	6.0E-10	4.2E-10	3.4E-10	2.6E-10	1.1E-10
E	2.0E-09	8.2E-10	6.2E-10	4.4E-10	3.7E-10	2.8E-10	1.3E-10
ENE	2.1E-09	9.8E-10	7.2E-10	5.0E-10	4.0E-10	3.0E-10	1.3E-10
NE	2.0E-09	9.6E-10	7.3E-10	5.4E-10	4.5E-10	3.5E-10	1.8E-10
NNE	1.8E-09	9.2E-10	6.7E-10	4.7E-10	3.8E-10	2.8E-10	1.2E-10

Distance (m)

Direction	2629
N	1.0E-10
NNW	4.7E-11
NW	6.8E-11
WNW	8.1E-11
W	1.3E-10
WSW	8.3E-11
SW	8.3E-11
SSW	6.2E-11
S	8.7E-11
SSE	8.0E-11
SE	1.1E-10
ESE	1.1E-10
E	1.2E-10
ENE	1.2E-10
NE	1.6E-10
NNE	1.1E-10

ATTACHMENT D

CAP88-PC REPORTS – POPULATION

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Population Assessment
May 30, 2008 12:44 pm

Facility: Niagara Falls Storage Site
Address: 1397 Pletcher Road
City: Lewiston
State: NY Zip: 14174

Source Category: Area Source
Source Type: Area
Emission Year: 2007

Comments: Tech Memo 2007
Cap88V3

Dataset Name: NFSS 2007 Pop
Dataset Date: 5/30/2008 11:53:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WindLib\IAG0905.WND
Population File: C:\Program Files\CAP88-PC30\Poplib\NFSS2003.POP

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)	Collective Population (person-rem/y)
INGESTION	1.44E-05	5.85E-04
INHALATION	1.74E-02	2.41E-02
AIR IMMERSION	6.37E-08	8.86E-08
GROUND SURFACE	6.21E-04	1.42E-03
INTERNAL	1.75E-02	2.47E-02
EXTERNAL	6.21E-04	1.42E-03
TOTAL	1.81E-02	2.61E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem/y)	Collective Population (person-rem/y)
U-238	1.62E-03	2.28E-03
Th-234	1.16E-05	2.36E-05
Pa-234m	1.04E-04	2.37E-04
Pa-234	5.41E-10	7.47E-10
U-234	1.87E-03	2.63E-03
Th-230	1.95E-03	2.73E-03
Ra-226	5.60E-04	9.41E-04
Rn-222	1.23E-14	2.70E-14
Po-218	2.27E-09	5.16E-09
Pb-214	6.49E-05	1.46E-04
Bi-214	3.80E-04	8.63E-04
Po-214	2.07E-08	4.72E-08
Pb-210	1.82E-04	4.18E-04
Bi-210	2.45E-05	4.26E-05
Po-210	5.25E-04	7.77E-04
At-218	0.00E+00	0.00E+00
Th-232	1.36E-04	1.87E-04
Ra-228	1.44E-05	1.99E-05
Ac-228	6.60E-08	9.13E-08
Th-228	2.63E-04	3.64E-04
Ra-224	1.97E-05	2.73E-05
Rn-220	4.69E-13	1.03E-12
Po-216	2.01E-14	2.78E-14
Pb-212	1.14E-06	1.57E-06
Bi-212	2.05E-07	2.83E-07
Po-212	0.00E+00	0.00E+00
Tl-208	1.58E-09	2.18E-09
U-235	1.83E-04	2.69E-04
Th-231	1.48E-06	3.36E-06
Pa-231	5.15E-03	7.16E-03
Ac-227	4.01E-03	5.56E-03
Th-227	5.73E-04	8.01E-04
Ra-223	4.21E-04	5.97E-04
Rn-219	5.58E-10	1.22E-09
Po-215	1.55E-08	3.54E-08
Pb-211	9.39E-06	2.08E-05
Bi-211	4.07E-06	9.28E-06
Tl-207	5.13E-06	1.17E-05
Po-211	2.15E-13	2.97E-13
Fr-223	7.92E-09	1.09E-08
TOTAL	1.81E-02	2.61E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
Esophagu	1.34E-11	3.14E-10
Stomach	3.77E-11	9.62E-10
Colon	9.69E-11	2.77E-09
Liver	3.41E-10	6.54E-09
LUNG	7.00E-09	1.26E-07
Bone	2.22E-10	4.32E-09
Skin	1.40E-11	4.08E-10
Breast	3.55E-11	9.64E-10
Ovary	4.70E-11	9.42E-10
Bladder	3.20E-11	7.48E-10
Kidneys	3.25E-11	8.09E-10
Thyroid	3.08E-12	7.84E-11
Leukemia	6.63E-11	1.61E-09
Residual	1.36E-10	3.67E-09
Total	8.08E-09	1.50E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
INGESTION	4.33E-12	2.34E-09
INHALATION	7.79E-09	1.40E-07
AIR IMMERSION	3.41E-14	6.14E-13
GROUND SURFACE	2.84E-10	8.37E-09
INTERNAL	7.80E-09	1.42E-07
EXTERNAL	2.84E-10	8.37E-09
TOTAL	8.08E-09	1.50E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
U-238	1.35E-09	2.43E-08
Th-234	7.81E-12	2.03E-10
Pa-234m	1.67E-11	4.92E-10
Pa-234	3.45E-16	6.17E-15
U-234	1.56E-09	2.81E-08
Th-230	1.01E-09	1.81E-08
Ra-226	4.72E-10	9.19E-09
Rn-222	6.69E-21	1.90E-19
Po-218	1.24E-15	3.67E-14
Pb-214	3.49E-11	1.01E-09
Bi-214	2.02E-10	5.94E-09
Po-214	1.14E-14	3.36E-13
Pb-210	1.11E-10	2.71E-09
Bi-210	1.40E-11	2.67E-10
Po-210	4.43E-10	8.18E-09
At-218	0.00E+00	0.00E+00
Th-232	6.02E-11	1.08E-09
Ra-228	6.89E-12	1.23E-10
Ac-228	4.21E-14	7.54E-13
Th-228	2.26E-10	4.04E-09
Ra-224	1.70E-11	3.04E-10
Rn-220	2.56E-19	7.27E-18
Po-216	1.10E-20	1.97E-19
Pb-212	9.81E-13	1.76E-11
Bi-212	1.32E-13	2.37E-12
Po-212	0.00E+00	0.00E+00
Tl-208	8.72E-16	1.56E-14
U-235	1.49E-10	2.76E-09
Th-231	6.80E-13	1.99E-11
Pa-231	4.88E-10	8.80E-09
Ac-227	1.06E-09	1.90E-08
Th-227	4.94E-10	8.91E-09
Ra-223	3.59E-10	6.55E-09
Rn-219	3.02E-16	8.55E-15
Po-215	8.52E-15	2.52E-13
Pb-211	3.44E-12	9.54E-11
Bi-211	2.23E-12	6.58E-11
Tl-207	6.55E-13	1.93E-11
Po-211	1.18E-19	2.11E-18
Fr-223	6.70E-15	1.20E-13
TOTAL	8.08E-09	1.50E-07

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Distance (m)

Direction	250	750	1500	2500	3500	4500	7500
N	1.8E-02	1.4E-03	4.4E-04	2.0E-04	1.2E-04	8.0E-05	3.6E-05
NNW	1.8E-02	1.1E-03	2.3E-04	6.2E-05	3.6E-05	2.4E-05	1.1E-05
NW	1.8E-02	9.2E-04	2.6E-04	1.1E-04	6.4E-05	4.3E-05	2.0E-05
WNW	1.8E-02	1.5E-03	3.8E-04	1.4E-04	8.3E-05	5.6E-05	2.5E-05
W	1.8E-02	1.6E-03	5.3E-04	2.5E-04	1.5E-04	1.0E-04	4.5E-05
WSW	1.8E-02	1.6E-03	4.0E-04	1.5E-04	8.6E-05	5.8E-05	2.7E-05
SW	1.8E-02	1.1E-03	3.4E-04	1.5E-04	8.6E-05	5.8E-05	2.6E-05
SSW	1.8E-02	1.2E-03	2.8E-04	9.7E-05	5.6E-05	3.8E-05	1.7E-05
S	1.8E-02	1.1E-03	3.5E-04	1.6E-04	9.2E-05	6.2E-05	2.8E-05
SSE	1.8E-02	1.5E-03	3.8E-04	1.4E-04	8.1E-05	5.5E-05	2.5E-05
SE	1.8E-02	1.6E-03	5.0E-04	2.2E-04	1.3E-04	8.8E-05	4.0E-05
ESE	1.8E-02	1.9E-03	5.2E-04	2.0E-04	1.2E-04	8.0E-05	3.7E-05
E	1.8E-02	1.9E-03	5.7E-04	2.5E-04	1.4E-04	9.7E-05	4.4E-05
ENE	1.8E-02	2.3E-03	6.0E-04	2.3E-04	1.3E-04	9.1E-05	4.2E-05
NE	1.8E-02	2.3E-03	7.3E-04	3.4E-04	2.0E-04	1.4E-04	6.2E-05
NNE	1.8E-02	2.2E-03	5.7E-04	2.2E-04	1.3E-04	8.8E-05	4.0E-05

Distance (m)

Direction	15000	25000	35000	45000	55000	65000	75000
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-06	9.6E-07
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.7E-07	4.1E-07	3.3E-07
NW	7.1E-06	0.0E+00	0.0E+00	0.0E+00	9.1E-07	6.3E-07	5.0E-07
WNW	9.2E-06	0.0E+00	0.0E+00	0.0E+00	1.1E-06	7.5E-07	5.9E-07
W	1.6E-05	7.4E-06	4.5E-06	3.0E-06	2.1E-06	1.4E-06	1.1E-06
WSW	9.7E-06	4.4E-06	2.7E-06	1.9E-06	1.3E-06	8.9E-07	7.0E-07
SW	9.7E-06	4.4E-06	2.7E-06	1.8E-06	1.3E-06	8.9E-07	0.0E+00
SSW	6.2E-06	2.8E-06	1.8E-06	1.2E-06	0.0E+00	6.1E-07	4.8E-07
S	1.0E-05	4.7E-06	2.9E-06	2.0E-06	1.4E-06	9.4E-07	7.4E-07
SSE	9.1E-06	4.2E-06	2.6E-06	1.8E-06	1.2E-06	8.8E-07	6.9E-07
SE	1.5E-05	6.6E-06	4.1E-06	2.8E-06	1.9E-06	1.4E-06	1.1E-06
ESE	1.3E-05	6.1E-06	3.8E-06	2.6E-06	1.8E-06	1.3E-06	1.0E-06
E	1.6E-05	7.4E-06	4.6E-06	3.1E-06	2.2E-06	1.5E-06	1.2E-06
ENE	1.5E-05	7.1E-06	4.4E-06	3.0E-06	2.1E-06	1.5E-06	1.2E-06
NE	2.3E-05	1.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
NNE	1.5E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-06

COLLECTIVE EFFECTIVE DOSE EQUIVALENT (person rem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	7500
N	1.6E-04	3.9E-05	4.2E-05	2.7E-05	2.2E-05	1.9E-05	4.9E-05
NNW	1.6E-04	3.0E-05	2.3E-05	8.3E-06	6.7E-06	5.4E-06	1.7E-05
NW	1.6E-04	2.6E-05	2.9E-05	1.7E-05	1.2E-05	1.1E-05	1.6E-04
WNW	1.6E-04	4.1E-05	4.2E-05	2.7E-05	2.0E-05	3.2E-05	9.5E-05
W	1.6E-04	4.4E-05	5.8E-05	4.7E-05	2.4E-04	3.3E-05	5.1E-05
WSW	1.6E-04	4.4E-05	4.4E-05	2.7E-05	1.3E-04	1.1E-04	1.8E-04
SW	1.6E-04	3.2E-05	3.7E-05	2.7E-05	2.8E-05	1.2E-04	3.2E-04
SSW	1.6E-04	3.3E-05	3.1E-05	1.8E-05	1.6E-05	5.8E-05	1.9E-04
S	1.6E-04	3.2E-05	3.9E-05	2.9E-05	2.0E-05	1.8E-05	2.9E-04
SSE	1.6E-04	4.2E-05	4.2E-05	2.6E-05	1.8E-05	1.6E-05	1.1E-04
SE	1.6E-04	4.6E-05	5.5E-05	4.1E-05	3.1E-05	2.5E-05	1.2E-04
ESE	1.6E-04	5.4E-05	5.7E-05	3.8E-05	3.0E-05	2.6E-05	9.2E-05
E	1.6E-04	5.4E-05	6.3E-05	4.5E-05	3.7E-05	3.2E-05	1.1E-04
ENE	1.6E-04	6.5E-05	6.7E-05	4.2E-05	2.6E-05	1.9E-05	1.3E-04
NE	1.6E-04	6.4E-05	7.9E-05	4.2E-05	2.3E-05	1.9E-05	1.7E-04
NNE	1.6E-04	6.1E-05	5.6E-05	3.0E-05	2.4E-05	1.8E-05	6.0E-05

	Distance (m)						
Direction	15000	25000	35000	45000	55000	65000	75000
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.4E-05	2.8E-04
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.2E-04	4.4E-04	2.3E-04
NW	7.2E-06	0.0E+00	0.0E+00	0.0E+00	4.5E-06	5.1E-04	2.6E-04
WNW	3.2E-05	0.0E+00	0.0E+00	0.0E+00	1.1E-09	1.9E-04	5.2E-05
W	4.3E-04	4.8E-04	4.3E-05	8.4E-05	4.3E-05	2.3E-04	2.7E-04
WSW	1.4E-04	2.1E-04	2.2E-05	1.3E-05	7.0E-06	8.7E-06	4.0E-06
SW	6.8E-04	2.5E-05	1.6E-04	2.5E-05	2.4E-06	6.1E-07	0.0E+00
SSW	7.2E-04	6.6E-06	1.4E-05	5.2E-06	0.0E+00	8.5E-08	7.1E-06
S	9.2E-04	2.5E-04	2.7E-04	1.1E-05	1.4E-04	5.8E-05	2.7E-05
SSE	7.1E-04	1.9E-03	2.3E-03	8.2E-04	2.0E-04	3.8E-05	1.7E-05
SE	2.6E-04	7.9E-04	7.6E-04	3.0E-04	9.0E-05	3.2E-05	2.4E-05
ESE	1.5E-04	5.0E-04	5.9E-05	6.3E-05	4.0E-05	8.7E-05	3.2E-05
E	1.6E-04	3.9E-04	7.3E-05	1.2E-04	3.4E-05	5.9E-05	4.7E-05
ENE	8.8E-05	1.5E-04	4.2E-05	2.0E-05	1.2E-05	5.1E-06	2.3E-06
NE	1.9E-04	1.2E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
NNE	7.8E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-05

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Distance (m)

Direction	250	750	1500	2500	3500	4500	7500
N	8.0E-09	6.2E-10	2.0E-10	9.0E-11	5.2E-11	3.6E-11	1.6E-11
NNW	8.1E-09	4.8E-10	1.0E-10	2.8E-11	1.6E-11	1.1E-11	4.9E-12
NW	8.0E-09	4.1E-10	1.2E-10	5.0E-11	2.9E-11	1.9E-11	8.7E-12
WNW	8.0E-09	6.6E-10	1.7E-10	6.4E-11	3.7E-11	2.5E-11	1.1E-11
W	8.0E-09	7.0E-10	2.3E-10	1.1E-10	6.5E-11	4.5E-11	2.0E-11
WSW	8.0E-09	7.1E-10	1.8E-10	6.6E-11	3.8E-11	2.6E-11	1.2E-11
SW	8.0E-09	5.1E-10	1.5E-10	6.6E-11	3.8E-11	2.6E-11	1.2E-11
SSW	8.0E-09	5.2E-10	1.2E-10	4.3E-11	2.5E-11	1.7E-11	7.7E-12
S	8.0E-09	5.1E-10	1.6E-10	7.1E-11	4.1E-11	2.8E-11	1.3E-11
SSE	8.1E-09	6.8E-10	1.7E-10	6.3E-11	3.6E-11	2.5E-11	1.1E-11
SE	8.1E-09	7.3E-10	2.2E-10	1.0E-10	5.8E-11	3.9E-11	1.8E-11
ESE	8.1E-09	8.6E-10	2.3E-10	9.1E-11	5.3E-11	3.6E-11	1.6E-11
E	8.0E-09	8.7E-10	2.5E-10	1.1E-10	6.4E-11	4.3E-11	2.0E-11
ENE	8.1E-09	1.0E-09	2.7E-10	1.0E-10	6.0E-11	4.1E-11	1.9E-11
NE	8.1E-09	1.0E-09	3.3E-10	1.5E-10	8.9E-11	6.0E-11	2.8E-11
NNE	8.1E-09	9.8E-10	2.6E-10	1.0E-10	5.8E-11	3.9E-11	1.8E-11

Distance (m)

Direction	15000	25000	35000	45000	55000	65000	75000
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.4E-13	4.2E-13
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-13	1.7E-13	1.4E-13
NW	3.1E-12	0.0E+00	0.0E+00	0.0E+00	4.0E-13	2.7E-13	2.1E-13
WNW	4.1E-12	0.0E+00	0.0E+00	0.0E+00	5.0E-13	3.3E-13	2.5E-13
W	7.3E-12	3.3E-12	2.0E-12	1.3E-12	9.1E-13	6.1E-13	4.7E-13
WSW	4.3E-12	2.0E-12	1.2E-12	8.2E-13	5.7E-13	3.9E-13	3.0E-13
SW	4.3E-12	2.0E-12	1.2E-12	8.2E-13	5.6E-13	3.9E-13	0.0E+00
SSW	2.8E-12	1.3E-12	7.8E-13	5.3E-13	0.0E+00	2.6E-13	2.1E-13
S	4.6E-12	2.1E-12	1.3E-12	8.6E-13	6.0E-13	4.1E-13	3.2E-13
SSE	4.1E-12	1.9E-12	1.1E-12	7.8E-13	5.4E-13	3.8E-13	3.0E-13
SE	6.5E-12	3.0E-12	1.8E-12	1.2E-12	8.5E-13	6.0E-13	4.7E-13
ESE	5.9E-12	2.7E-12	1.7E-12	1.1E-12	8.0E-13	5.6E-13	4.4E-13
E	7.2E-12	3.3E-12	2.0E-12	1.4E-12	9.7E-13	6.8E-13	5.3E-13
ENE	6.9E-12	3.2E-12	2.0E-12	1.3E-12	9.5E-13	6.8E-13	5.4E-13
NE	1.0E-11	4.7E-12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
NNE	6.6E-12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.1E-13

COLLECTIVE FATAL CANCER RATE (deaths/y)
(All Radionuclides and Pathways)

Distance (m)

Direction	250	750	1500	2500	3500	4500	7500
N	9.4E-10	2.3E-10	2.4E-10	1.6E-10	1.3E-10	1.1E-10	2.8E-10
NNW	9.4E-10	1.8E-10	1.3E-10	4.8E-11	3.9E-11	3.1E-11	9.8E-11
NW	9.4E-10	1.5E-10	1.7E-10	9.7E-11	7.0E-11	6.5E-11	9.4E-10
WNW	9.4E-10	2.4E-10	2.4E-10	1.5E-10	1.2E-10	1.9E-10	5.5E-10
W	9.4E-10	2.6E-10	3.4E-10	2.7E-10	1.4E-09	1.9E-10	2.9E-10
WSW	9.4E-10	2.6E-10	2.6E-10	1.6E-10	7.6E-10	6.6E-10	1.0E-09
SW	9.3E-10	1.8E-10	2.2E-10	1.6E-10	1.6E-10	7.1E-10	1.9E-09
SSW	9.4E-10	1.9E-10	1.8E-10	1.0E-10	9.3E-11	3.4E-10	1.1E-09
S	9.4E-10	1.9E-10	2.3E-10	1.7E-10	1.2E-10	1.1E-10	1.7E-09
SSE	9.4E-10	2.5E-10	2.4E-10	1.5E-10	1.0E-10	9.0E-11	6.6E-10
SE	9.4E-10	2.7E-10	3.2E-10	2.4E-10	1.8E-10	1.4E-10	7.2E-10
ESE	9.4E-10	3.1E-10	3.3E-10	2.2E-10	1.8E-10	1.5E-10	5.3E-10
E	9.4E-10	3.2E-10	3.6E-10	2.6E-10	2.1E-10	1.9E-10	6.1E-10
ENE	9.4E-10	3.8E-10	3.9E-10	2.4E-10	1.5E-10	1.1E-10	7.7E-10
NE	9.4E-10	3.7E-10	4.6E-10	2.4E-10	1.3E-10	1.1E-10	9.6E-10
NNE	9.4E-10	3.5E-10	3.3E-10	1.7E-10	1.4E-10	1.1E-10	3.5E-10

Distance (m)

Direction	15000	25000	35000	45000	55000	65000	75000
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.4E-10	1.6E-09
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.7E-10	2.4E-09	1.3E-09
NW	4.1E-11	0.0E+00	0.0E+00	0.0E+00	2.6E-11	2.9E-09	1.5E-09
WNW	1.9E-10	0.0E+00	0.0E+00	0.0E+00	6.4E-15	1.1E-09	2.9E-10
W	2.5E-09	2.7E-09	2.5E-10	4.9E-10	2.5E-10	1.3E-09	1.5E-09
WSW	8.3E-10	1.2E-09	1.3E-10	7.2E-11	4.0E-11	4.9E-11	2.2E-11
SW	3.9E-09	1.4E-10	8.9E-10	1.5E-10	1.4E-11	3.5E-12	0.0E+00
SSW	4.1E-09	3.8E-11	7.7E-11	3.0E-11	0.0E+00	4.8E-13	4.0E-11
S	5.3E-09	1.4E-09	1.6E-09	6.4E-11	8.2E-10	3.3E-10	1.5E-10
SSE	4.1E-09	1.1E-08	1.3E-08	4.7E-09	1.1E-09	2.1E-10	9.5E-11
SE	1.5E-09	4.5E-09	4.4E-09	1.7E-09	5.2E-10	1.8E-10	1.3E-10
ESE	8.6E-10	2.9E-09	3.4E-10	3.6E-10	2.3E-10	5.0E-10	1.8E-10
E	9.0E-10	2.3E-09	4.2E-10	6.8E-10	1.9E-10	3.4E-10	2.7E-10
ENE	5.1E-10	8.9E-10	2.4E-10	1.2E-10	7.2E-11	2.9E-11	1.3E-11
NE	1.1E-09	7.0E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
NNE	4.5E-11	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-10

ATTACHMENT E

NATIONAL CLIMATIC DATA CENTER, NIAGARA FALLS, NEW YORK

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY
(2007)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **305840/99999, NIAGARA FALLS INTL AP, New York** Elev. 519 ft. above sea level Lat. 43°06'N, Lon. 78°57'W

Date	Temperature (° F)														Precipitation (inches)									
Elem->	MMXT	MMNT	MNTM	DPNT	HTDD	CLDD	EMXT		EMNP		DT90	DX32	DT32	DT00	TPCP	DPNP	EMXP		TSNW	MXSD		DP01	DP05	DP10
											Number of Days						Greatest Observed		Snow, Sleet			Number of Days		
2007 Month	Mean Max.	Mean Min.	Mean	Depart. from Normal	Heating Degree Days	Cooling Degree Days	Highest	High Date	Lowest	Low Date	Max >=90°	Max <=32°	Min <=32°	Min <=0°	Total	Depart. from Normal	Day	Date	Total Fall	Max Depth	Max Date	>=.10	>=.50	>=1.0
1	36.6	20.8	28.7	4.5	1115	0	54	9	2	29	0	14	25	0	3.74	1.19	0.87	15	18.2	7	29	10	2	0
2	24.7	11.9	18.3	-7.0	1300	0	40	20	0	15	0	23	28	2	1.43	-0.89	0.23	14	41.0	14	15	6	0	0
3	43.4	25.2	34.3	0.5	946	0	68	26	-1	6	0	7	22	1	2.01	-0.62	0.43	26	11.6	7	1	6	0	0
4	51.5	33.2	42.4	-2.7	674	0	77	23	19	7	0	3	12	0	3.09	0.63	0.85	16	1.8	1	6	8	2	0
5	70.5	45.7	58.1	1.0	251	41	87	24	33	7	0	0	0	0	0.84	-2.10	0.47	15	0.0	0		2	0	0
6	80.6	56.9	68.8	3.0	35	156	92	26	43	6	1	0	0	0	1.70	-1.56	0.83	3	0.0	0		2	2	0
7	79.8	58.8	69.3	-2.1	10	152	92	10	49	2	2	0	0	0	2.78	0.09	1.46	19	0.0	0		6	1	1
8	81.2	60.5	70.9	1.3	14	206	94	2	50	18	4	0	0	0	1.54	-1.49	0.93	3	0.0	0		3	1	0
9	M	M	M	M	M	M	M		M		M	M	M	M	M	M	M		M	M		M	M	M
10	67.0	48.6	57.8	7.7	245	32	85	5	28	29	0	0	2	0	1.88	-0.79	0.67	23	0.0	0		5	2	0
11	45.6	29.5	37.6	-2.3	817	0	60	14	14	24	0	1	18	0	3.24	0.26	1.29	21	0.9	0T	7	8	1	1
12	34.4	22.4	28.4	-1.3	1129	0	51	23	10	15	0	9	30	0	3.97	1.09	0.87	23	35.2	14	17	9	3	0
Annual	M	M	M	M	M	M	M	Aug	M	Mar	M	M	M	M	M	M	M	Jul	M	M	Dec	M	M	M

Notes

(blank) Not reported.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence. Used through December 1983 only.

A Accumulated amount. This value is a total that may include data from a previous month or months or year (for annual value).

B Adjusted Total. Monthly value totals based on proportional available data across the entire month.

E An estimated monthly or annual total.

X Monthly means or totals based on incomplete time series. 1 to 9 days are missing. Annual means or totals include one or more months which had 1 to 9 days that were missing.

M Used to indicate data element missing.

T Trace of precipitation, snowfall, or snowdepth. The precipitation data value will = zero.

Elem-> Element Types are included to provide cross-reference for users of the NCDC CDO System.

Station Station is identified by: CoopID/WBAN, Station Name, State.

S Precipitation amount is continuing to be accumulated. Total will be included in a subsequent monthly or yearly value. Example: Days 1-20 had 1.35 inches of precipitation, then a period of accumulation began. The element TPCP would then be 00135S and the total accumulated amount value appears in a subsequent monthly value. If TPCP = "M" there was no precipitation measured during the month. Flag is set to "S" and the total accumulated amount appears in a subsequent monthly value.

Dynamically generated Thu May 29 16:24:14 EDT 2008 via http://hurricane/ancsum/ACS
Data provided from the NCDC CDO System
Additional documentation can be found at http://www5.ncdc.noaa.gov/cdo/3220doc.txt

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 01/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC Depth	1800 UTC Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	max 5-second Dir	max 2-minute Speed	max 2-minute Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	51	38	45	M	38	42	20	0	-	-	RA	0	M	0.0	0.11	29.11	29.79	14.7	23	16.6	35	190	28	230	01
02	42	30	36	M	28	33	29	0	-	-		0	M	0.0	0.00s	29.56	30.27	11.2	25	13.1	29	300	23	290	02
03	45	36	41	M	30	36	24	0	-	-		0	M	0.0	0.00	29.51	30.17	17.5	22	17.6	40	220	32	220	03
04	52	41	47	M	35	42	18	0	-	-	RA	0	M	0.0	0.03	29.33	29.96	17.2	21	17.3	39	220	35	220	04
05	54	46	50*	M	48	49	15	0	-	-	RA DZ BR	0	M	0.0	0.80	29.10	29.72	8.4	21	9.8	32	210	26	210	05
06	54*	38	46	M	41	44	19	0	-	-	RA DZ BR	0	M	0.0	0.24	29.05	29.76	13.1	24	15.3	39	230	30	240	06
07	41	30	36	M	29	34	29	0	-	-	RA DZ BR	0	M	0.0	0.06	29.49	30.13	1.3	14	7.6	21	260	17	260	07
08	42	31	37	M	30	34	28	0	-	-	RA SN BR	0	M	T	0.16	28.96	29.64	17.0	24	18.2	47	250	38	260	08
09	54s	25	M	M	21	27	M	M	-	-	SN FG+ FZFG	0	M	T	T	29.11	29.81	15.0	26	15.2	29	280	24	280	09
10	27	15	21	M	13	19	44	0	-	-	SN FZFG	T	M	2.2	0.14	29.52	30.27	12.4	27	12.8	29	300	25	280	10
11	43	13	28	M	18	29	37	0	-	-		0	M	0.0	0.00	29.63	30.29	14.2	18	14.6	30	180	24	190	11
12	49	37	43	M	39	42	22	0	-	-	RA DZ BR	0	M	0.0	0.36	29.47	30.14	16.7	22	16.9	41	240	35	230	12
13	49	28	39	M	29	31	26	0	-	-	RA SN BR	T	M	0.5	0.42	29.59	30.28	6.4	01	10.5	25	230	21	230	13
14	32	29	31	M	27	29	34	0	-	-	FZRA SN BR	T	M	0.3	0.11	29.60	30.29	7.7	06	8.1	16	060	14	070	14
15	48s	26	M	M	27	29	M	M	-	-	FZRA FZDZ SN BR UP	0	M	0.1	0.87	29.28	29.92	6.4	04	8.7	22	090	17	080	15
16	26	14	20	M	12	17	45	0	-	-	SN BR	T	M	0.8	0.01	29.54	30.30	11.9	31	12.7	22	320	18	310	16
17	26	13	20	M	14	18	45	0	-	-	SN BR HZ	1	M	0.8	0.01	29.94	30.65	4.6	22	7.9s	20	230	17	230	17
18	35	22	29	M	21	27	36	0	-	-	SN BR	0	M	T	T	29.61	30.24	11.1	20	11.5	26	200	21	200	18
19	34	22	28	M	22	26	37	0	-	-	SN BR	1	M	1.3	0.03	29.23	29.91	18.2	26	18.6	31s	270	26	270	19
20	22	7	15	M	8	15	50	0	-	-	SN	1	M	0.2s	T	29.52	30.27	11.5	29	12.7	33	280	26	280	20
21	21	4	13	M	8	13	52	0	-	-	SN	1	M	T	T	29.64	30.30	6.4	09	6.7	20	090	16	090	21
22	26	19	23	M	18	21	42	0	-	-	SN BR	2	M	1.7	0.06	29.26	29.94	2.7	02	4.9	15	260	13	250	22
23	31	18	25	M	22	26	40	0	-	-	SN BR	3	M	1.1	0.02	29.18	29.86	13.7	24	14.0	31	270	26	270	23
24	29	16	23	M	17	23	42	0	-	-	SN BR	4	M	0.6	0.01	29.31	30.01	5.7	30	9.2	22	250	18	320	24
25	19	7	13	M	3	10	52	0	-	-	SN BR	3	M	0.6	0.02	29.36	30.08	11.1	33	11.5	28	330	23	320	25
26	19	3	11	M	6	11	54	0	-	-	SN HZ	3	M	0.9	0.02	29.34	30.02	2.7	21	8.1	18	090	16	250	26
27	37	18	28	M	24	28	37	0	-	-	DZ SN GS BR	3	M	0.1	0.01	28.98	29.65	7.2	26	10.9	26	230	21	230	27
28	29	17	23	M	17	20	42	0	-	-	SN BR	2	M	4.7	0.18	29.07	29.77	6.8	35	9.8	20	250	16	250	28
29	20	2*	11*	M	6	12	54	0	-	-	SN	7	M	0.5s	T	29.28	29.99	11.2	26	11.8	28	260	23	250	29
30	23	11	17	M	14	18	48	0	-	-	SN BR HZ	6	M	1.5	0.04	29.23	29.92	4.6	23	6.7	20	260	16	260	30
31	24	7	16	M	11	17	49	0	-	-	SN BLSN	6	M	T	T	29.33	30.03	17.2	24	17.7	39	270	32	260	31
	35.6	21.4	28.5		21.8	26.5	36.9	0.0	<-----Monthly Averages | Totals----->			M		18.2	3.74s	29.36	30.04	6.9	25	12.2	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	1070	M	M	M
Cooling:	0	M		

Greatest 24-hr Precipitation: 0.91s Date: 14-15
Greatest 24-hr Snowfall: 0.5 Date: 28
Greatest Snow Depth: 7s Date: 29

Sea Level Pressure	Date	Time (LST)
Maximum 30.72	17	1119
Minimum 29.49	08	0530

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 15
Thunderstorms : 0
Min Temp <=32: 25
Min Temp <=0 : 0
Heavy Fog : 1
Precipitation >=.01 inch: 23s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 02/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	28	20	24	M	17	23	41	0	-	-	SN BR	5	M	2.2	0.06	29.20	29.87	12.2	21	12.5	31	190	24	220	01
02	28	13	21	M	17	22	44	0	-	-	SN BR BLSN	4	M	0.7	0.05	29.02	29.69	10.1	25	10.9	38	240	31	250	02
03	19	8	14	M	5	11	51	0	-	-	SN FG+ FZFG BLSN	5	M	5.8	0.09	29.16	29.88	21.9	24	22.7	43	250	35	250	03
04	8	1	5*	M	-6	2	60	0	-	-	HZ	5	M	0.0	0.00	29.35	30.07	23.5	26	23.8	40	260	35	270	04
05	11	0	6	M	-3	4	59	0	-	-	HZ	4	M	0.0	0.00	29.48	30.22	25.3	25	25.3	43	240	33	240	05
06	25s	4	M	M	-1	6	M	M	-	-	SN	4	M	T	T	29.51	30.20	17.8	24	18.1	32	240	26	260	06
07	17	5	11	M	1	9	54	0	-	-		3	M	0.0	0.00	29.33	30.03	19.1	24	19.4	37	250	30	240	07
08	22	13	18	M	8	15	47	0	-	-	SN BLSN	3	M	0.5	0.02	29.28	29.97	22.1	25	22.6	44	240	35	240	08
09	25	9s	M	M	11	17	M	M	-	-	SN	3	M	0.4	0.01	29.36	30.08	16.8	25	17.3	29	260	24	250	09
10	23	10	17	M	8	16	48	0	-	-	SN	3	M	T	T	29.39	30.09	16.3	25	16.5	31	260	25	260	10
11	23	11	17	M	11	16	48	0	-	-	SN BLSN	4	M	2.0	0.05	29.47	30.17	20.4	23	20.7	41	230	33	220	11
12	26	12	19	M	13	19	46	0	-	-	SN	3	M	0.3s	T	29.57	30.29	5.9	29	12.3	26	240	23	240	12
13	12	8	10	M	3	9	55	0	-	-	SN BR	3	M	3.6	0.10	29.70	30.38	15.0	06	15.9	32	060	26	060	13
14	16	9	13	M	8	12	52	0	-	-	SN BR BLSN	9	M	7.9	0.23	29.27	29.96	13.8	36	17.7	32	040	26	310	14
15	14	0*	7	M	0	7	58	0	-	-	SN BR HZ BLSN	14	M	0.9	0.03	29.29	29.99	17.2	26	18.0	36	260	29	250	15
16	21	10	16	M	7	13	49	0	-	-	SN BLSN	13	M	T	T	29.18	29.87	21.6	24	21.9	41	230	35	230	16
17	24	14	19	M	13	18	46	0	-	-	SN BR HZ	10	M	1.6	0.05	29.10	29.78	16.6	23	16.8	43	230	36	230	17
18	21	7	14	M	7	13	51	0	-	-	SN BR BLSN	10	M	2.6	0.06	29.18	29.91	12.6	29	14.0	32	300	25	310	18
19	36	3	20	M	8	16	45	0	-	-	HZ	10	M	T	T	29.34	29.99	8.5	20	10.0	23	210	23	210	19
20	40*	11s	M	M	29	34	M	M	-	-	RA BR	9	M	0.0	0.04	29.00	29.68	9.9	24	12.3	31	240	26	240	20
21	36	23	30	M	24	28	35	0	-	-	BR HZ	7	M	0.0	0.00	29.23	29.91	4.5	23	6.2	17	200	14	220	21
22	37	22	30	M	26	29	35	0	-	-	RA DZ SN FG BR HZ BLSN	4	M	2.2	0.09	29.00	29.69	11.7	25	17.1	38	310	35	280	22
23	27	15	21	M	8	16	44	0	-	-	SN BR	7	M	2.8	0.13	29.52	30.26	15.7	32	16.1	33	310	28	320	23
24	22	6	14	M	8	14	51	0	-	-	SN BR	5	M	0.1s	T	29.66	30.37	4.1	30	5.9	24	320	17	330	24
25	31	10	21	M	17	21	44	0	-	-	SN FZFG BR HZ	5	M	1.9	0.19	29.37	30.00	12.6	08	12.7	30	080	24	090	25
26	32	27	30	M	27	29	35	0	-	-	SN BR	9	M	4.8	0.13	29.10	29.79	6.4	06	6.6	20	090	15	090	26
27	32	27	30*	M	26	28	35	0	-	-	SN BR	9	M	1.2	0.11	29.29	29.99	1.5	35	3.4	10	320	8	300	27
28	35	16	26	M	20	25	39	0	-	-	FG+ FZFG BR	8	M	0.0	0.00	29.48	30.18	1.5	32	3.3	14	020	9	290	28
	24.7	11.2	18.0		11.1	16.9	M	M	<-----Monthly Averages | Totals----->			M	M	0.65s		29.31	30.01	9.6	25	15.0	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	M	M		M
Cooling:	M	M	M	M

Greatest 24-hr Precipitation: 0.29s Date: 25-26
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level Pressure		Date	Time (LST)
Maximum	30.53	13	0923
Minimum	29.53	22	1110

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 23
Thunderstorms : 0
Min Temp <=32: 28
Min Temp <=0 : 2
Heavy Fog : 2
Precipitation >=.01 inch: 8s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 03/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC Depth	1800 UTC Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	max 5-second Dir	max 2-minute Speed	max 2-minute Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	32	17	25	M	17	24	40	0	-	-	RA FZRA FZDZ SN BR UP	7	M	0.6	0.11	29.34	29.96	14.6	08	14.7	32	080	25	090	01
02	39	19s	M	M	28	33	M	M	-	-	RA SN BR	5	M	T	0.31	28.76	29.42	10.0	21	16.8	37	220	31	220	02
03	34	28	31	M	22	28	34	0	-	-	SN	4	M	0.2s	T	28.92	29.60	21.9	23	22.2	44	240	37	240	03
04	29	25	27	M	19	24	38	0	-	-	SN BR BLSN	4	M	0.6s	T	29.13	29.82	18.2	25	18.9	31	240	25	230	04
05	28	8	18	M	9	18	47	0	-	-	SN	4	M	0.2s	T	29.23	29.96	22.5	29	25.0	48	290	39	280	05
06	10	-1*	5*	M	-6	3	60	0	-	-	SN	3	M	T	T	29.83	30.57	9.8	30	13.4	35	330	28	330	06
07	20	14s	M	M	6	12	M	M	-	-	SN HZ	3	M	0.8	0.02	M	M	7.1	23	M	21	240	17	240	07
08	26	12	19	M	9	16	46	0	-	-	SN BR	2	M	0.8	0.03	29.65	30.37	3.6	27	9.6	20	320	17	320	08
09	39	9	24	M	12	21	41	0	-	-		2	M	0.0	0.00	29.62	30.28	4.3	09	5.3	14	040	10	050	09
10	46	33	40	M	33	37	25	0	-	-	RA DZ FG+ FG BR	T	M	0.0	0.03	29.34	30.01	11.2	21	12.1	37	230	28	220	10
11	38	29	34	M	25	30	31	0	-	-		T	M	0.0	0.00	29.65	30.36	9.9	26	12.8	26	280	22	290	11
12	43	27	35	M	24	32	30	0	-	-	RA	T	M	0.0	T	29.57	30.22	10.7	20	11.1	22	220	18	220	12
13	58	39	49	M	37	43	16	0	-	-		T	M	0.0	0.00	29.30	29.93	14.3	21	14.4	36	230	28	220	13
14	54	42	48	M	47	48	17	0	-	-	RA DZ BR	0	M	0.0	0.03	29.16	29.82	9.6	22	12.3	21s	350	16	350	14
15	46s	26	M	M	23	30	M	M	-	-	SN BR UP	0	M	T	0.07	29.49	30.22	10.3	36	12.1	29	340	23	330	15
16	27	21	24	M	15	22	41	0	-	-	SN BR	0	M	1.0	0.04	29.59	30.25	17.4	05	17.8	32	050	28	050	16
17	31	21	26	M	15	22	39	0	-	-	SN FZFG BR	5	M	7.0	0.35	29.31	29.98	13.3	33	15.5	28	320	23	320	17
18	34	22	28	M	10	23	37	0	-	-		4	M	0.0	0.00	29.42	30.13	13.4	30	15.1	31	290	25	290	18
19	37	21	29	M	26	29	36	0	-	-	RA DZ SN PL BR	2	M	0.4	0.04	29.40	30.07	12.8	20	14.1	36	190	30	190	19
20	35	19	27	M	14	22	38	0	-	-		T	M	T	T	29.79	30.55	9.5	31	11.5	31	300	28	300	20
21	49	18	34	M	23	31	31	0	-	-	RA	T	M	0.0	0.02	29.79	30.41	7.8	15	9.8	26	180	22	180	21
22	61	39	50	M	43	47	15	0	-	-	TSRA RA BR	0	M	0.0	0.25	29.29	29.96	14.4	21	16.3	46	220	39	210	22
23	53	33	43	M	31	37	22	0	-	-	BR	0	M	0.0	0.00	29.54	30.21	1.4	34	2.7	13	330	10	310	23
24	47	32	40	M	36	38	25	0	-	-	RA FG+ FG BR	0	M	0.0	0.28	29.55	30.22	1.6	07	6.5	23	290	18	290	24
25	53	35	44	M	38	40	21	0	-	-	FG+ BR	0	M	0.0	0.00	29.73	30.39	4.8	06	6.3	17	080	15	100	25
26	68*	38	53	M	49	51	12	0	-	-	TS TSRA RA BR	0	M	0.0	0.43	29.39	30.01	8.0	22	9.6	33	230	29	230	26
27	66	39	53*	M	47	49	12	0	-	-	FG+ BR	0	M	0.0	0.00	29.42	30.10	1.1	03	5.1	22	360	20	360	27
28	50	32	41	M	25	35	24	0	-	-		0	M	0.0	0.00	29.78	30.47	12.9	04	13.4	28	050	23	040	28
29	49	28	39	M	18	31	26	0	-	-		0	M	0.0	0.00	29.94	30.62	7.7	05	8.0	21	040	16	050	29
30	53	26	40	M	20	33	25	0	-	-		0	M	0.0	0.00	29.73	30.38	3.7	02	4.8s	15	030	14	010	30
31	50	35	43	M	23	34	22	0	-	-		0	M	T	T	29.59	30.24	11.2	07	11.4	21	090	17	090	31
	45.3	27.6	36.5		23.8	30.4	30.4	0.0	<-----Monthly Averages | Totals----->			M	M	1.19s		29.54	30.22	2.8	25	12.3	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	851	M	M	M
Cooling:	0	M		

Greatest 24-hr Precipitation: 0.43 Date: 26
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level Pressure	Date	Time (LST)
Maximum 30.73	20	2329
Minimum 29.76	14	1716

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 4s
Thunderstorms : 3
Min Temp <=32: 16s
Min Temp <=0 : 0s
Heavy Fog : 4
Precipitation >=.01 inch: 9s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 04/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	60	42	51	M	42	47	14	0	-	-	RA BR	0	M	0.0	0.26	29.28	29.89	7.3	15	9.7	24	180	20	190	01
02	56	36	46	M	42	46	19	0	-	-	RA	0	M	0.0	0.05	29.20	29.87	12.6	23	13.9	32	240	28	230	02
03	58	34	46	M	37	41	19	0	-	-	RA BR	0	M	0.0	0.03	29.36	29.98	7.7	07	10.8	43	050	33	060	03
04	52	30	41	M	37	39	24	0	-	-	RA DZ SN BR	0	M	0.1	0.39	28.98	29.64	15.2	22	17.7	46	230	37	230	04
05	30	22	26	M	17	22	39	0	-	-	SN BR	T	M	0.2	0.01	29.11	29.80	19.2	26	19.7	37	280	32	270	05
06	46s	20	M	M	15	21	M	M	-	-	SN	1	M	0.2	0.01	29.14	29.82	15.3	26	15.4	31	270	25	260	06
07	30	19*	25*	M	17	22	40	0	-	-	SN FZFG BR	T	M	0.4s	T	29.08	29.76	12.9	25	13.7	29	260	23	270	07
08	32	22	27	M	22	26	38	0	-	-	SN BR	T	M	0.8s	T	29.23	29.93	14.8	26	15.0	26	270	22	260	08
09	36	27	32	M	21	28	33	0	-	-	SN	T	M	T	T	29.39	30.07	9.3	27	9.8	20	280	16	310	09
10	40	28	34	M	24	30	31	0	-	-	SN BR	0	M	T	T	29.44	30.12	3.7	25	6.1	15	230	13	220	10
11	48	24	36	M	29	33	29	0	-	-	RA BR HZ	0	M	0.0	0.10	29.36	29.98	12.5	08	13.1	29	060	25	060	11
12	50	37	44	M	38	41	21	0	-	-	RA BR	0	M	0.0	0.24	28.96	29.62	12.0	20	14.5	32	230	24	230	12
13	40	29	35	M	30	33	30	0	-	-	RA SN BR UP	0	M	T	0.03	29.26	29.97	15.8	26	16.3	32	240	25	280	13
14	43	25	34	M	27	33	31	0	-	-	SN BR	0	M	0.4	0.04	29.39	30.04	2.6	32	6.7	20	090	15	090	14
15	38	23s	M	M	34	35	M	M	-	-	RA SN BR UP	0	M	0.4	0.13	29.11	29.74	16.2	02	17.0	30	350	23	040	15
16	40	36	38	M	36	37	27	0	-	-	RA SN BR UP	0	M	T	0.85	28.84	29.51	20.7	33	20.9	38	330	31	330	16
17	46	38	42	M	36	39	23	0	-	-	RA BR	0	M	0.0	0.04	29.16	29.84	9.2	35	9.6	22	350	17	360	17
18	50	33	42	M	38	40	23	0	-	-	RA DZ BR	0	M	0.0	0.03	29.28	29.94	8.6	05	9.3	23	090	18	080	18
19	60	31	46	M	33	40	19	0	-	-		0	M	0.0	0.00	29.38	30.05	7.7	04	8.7	23	040	21	050	19
20	70	35	53	M	30	42	12	0	-	-		0	M	0.0	0.00	29.54	30.20	1.8	31	5.1	17	010	14	010	20
21	70	36	53	M	33	44	12	0	-	-		0	M	0.0	0.00	29.56	30.21	6.0	21	7.3	17	190	15	200	21
22	74	41	58	M	32	46	7	0	-	-		0	M	0.0	0.00	29.49	30.12	7.3	21	7.9	24	230	18	240	22
23	77*	48	63*	M	46	54	2	0	-	-	RA	0	M	0.0	0.09	29.25	29.87	12.2	23	14.9	48	220	36	230	23
24	59	41	50	M	34	43	15	0	-	-		0	M	0.0	0.00	29.44	30.11	5.9	30	7.7	26	310	23	320	24
25	50	36	43	M	40	43	22	0	-	-	RA HZ	0	M	0.0	0.11	29.44	30.10	3.9	14	5.2	14	150	12	150	25
26	63	39	51	M	45	47	14	0	-	-	TSRA RA BR	0	M	0.0	0.54	29.34	29.97	7.9	10	8.5	23	090	20	090	26
27	63	46	55	M	50	52	10	0	-	-	RA BR	0	M	0.0	0.07	29.08	29.72	12.0	21	13.2	29	230	23	220	27
28	49	44	47	M	45	46	18	0	-	-	RA DZ BR	0	M	0.0	0.07	29.15	29.80	9.3	22	9.4	20	210	16	210	28
29	66	40	53	M	44	48	12	0	-	-	RA BR	0	M	0.0	T	29.23	29.87	9.0	21	9.6	24	230	18	210	29
30	62	44	53	M	39	47	12	0	-	-		0	M	0.0	0.00	29.23	29.90	8.5	29	11.9	29	320	23	310	30
	51.9	33.5	42.7		33.8	38.8	21.3	0.0	<-----Monthly Averages | Totals----->			M	2.5	3.09s	29.26	29.91	4.3	25	11.6	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	596	M	M	M
Cooling:	0	M		

Greatest 24-hr Precipitation: 0.85 Date: 16-17
Greatest 24-hr Snowfall: 0.1 Date: 08
Greatest Snow Depth: 1s Date: 06

Sea Level Pressure		Date	Time (LST)
Maximum	30.27	21	0952
Minimum	29.41	16	0956

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 3
Thunderstorms : 1
Min Temp <=32: 12
Min Temp <=0 : 0
Heavy Fog : 0
Precipitation >=.01 inch: 19
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 05/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	54	39	47*	M	39	44	18	0	-	-	RA BR	0	M	0.0	0.02	29.31	29.95	6.2	06	7.1	24	060	20	060	01
02	64	36	50	M	35	44	15	0	-	-		0	M	0.0	0.00	29.39	30.07	4.1	36	5.0	17	050	13	360	02
03	62	40	51	M	27	41	14	0	-	-		0	M	0.0	0.00	29.62	30.28	7.8	04	8.6	20	010	16	010	03
04	67	36	52	M	28	43	13	0	-	-		0	M	0.0	0.00	29.62	30.26	4.6	06	5.2	23	040	17	050	04
05	65	39	52	M	29	43	13	0	-	-		0	M	0.0	0.00	29.57	30.25	9.7	04	9.9	25	030	22	030	05
06	60	40	50	M	25	40	15	0	-	-		0	M	0.0	0.00	29.84	30.51	9.0	05	10.1	24	100	18	350	06
07	71	33*	52	M	32	45	13	0	-	-		0	M	0.0	0.00	29.72	30.35	1.5	18	4.6	20	350	13	210	07
08	78	49	64	M	39	51	1	0	-	-		0	M	0.0	0.00	29.47	30.09	11.2	21	11.6	24	230	21	220	08
09	82	53	68	M	51	58	0	3	-	-	HZ	0	M	0.0	0.00	29.37	29.98	1.3	17	4.8	21	310	18	310	09
10	73	53	63	M	56	59	2	0	-	-	TSRA BR HZ	0	M	0.0	0.05	29.28	29.91	5.3	21	8.8	21	200	17	220	10
11	75	49	62	M	52	57	3	0	-	-	BR	0	M	0.0	0.00	29.30	29.95	4.2	33	7.7	22	340	16	340	11
12	58	44	51	M	35	44	14	0	-	-		0	M	0.0	0.00	29.48	30.14	10.5	04	11.7	22	050	18	060	12
13	61	38	50	M	25	40	15	0	-	-		0	M	0.0	0.00	29.65	30.31	5.7	03	7.1	18	030	15	020	13
14	67	37	52	M	34	45	13	0	-	-	RA	0	M	0.0	0.03	29.55	30.16	6.7	20	7.0	21	230	17	200	14
15	82	56	69	M	50	59	0	4	-	-	TS TSRA RA BR	0	M	0.0	0.47	29.15	29.76	15.2	22	17.2	44	270	31	240	15
16	62	45	54	M	52	53	11	0	-	-	RA DZ BR	0	M	0.0	0.17	29.10	29.76	2.8	31	10.2	26	220	22	260	16
17	58	40	49	M	39	44	16	0	-	-	RA BR	0	M	0.0	0.04	29.47	30.17	8.0	06	8.4	17	040	15	050	17
18	62	35	49	M	38	44	16	0	-	-		M	M	M	0.00	29.59	30.24	0.9	03	5.1	16	230	14	230	18
19	69	41	55	M	45	50	10	0	-	-	BR	0	M	0.0	0.00	29.41	30.04	8.3	20	8.6	18	200	16	200	19
20	57	45	51	M	46	49	14	0	-	-	RA BR	0	M	0.0	0.05	29.31	29.98	7.9	31	10.5	22	330	17	330	20
21	63	37	50	M	35	44	15	0	-	-		0	M	0.0	0.00	29.55	30.22	2.8	33	5.1	16	360	14	320	21
22	73	43	58	M	41	50	7	0	-	-		0	M	0.0	T	29.62	30.28	3.3	05	4.4	16	090	12	010	22
23	85	49	67	M	50	58	0	2	-	-		0	M	0.0	0.00	29.65	30.28	1.7	19	2.7	14	200	10	250	23
24	87*	49s	M	M	57	64	M	M	-	-	HZ	0	M	0.0	0.00	29.64	30.26	7.6	20	7.8	17	190	15	210	24
25	82	60	71	M	59	64	0	6	-	-	TS HZ	0	M	0.0	T	29.54	30.16	7.9	22	10.2	25	210	21	220	25
26	69	57	63	M	42	52	2	0	-	-	RA	0	M	0.0	T	29.57	30.19	2.8	35	4.9	16	360	12	340	26
27	77	59	68	M	58	62	0	3	-	-	RA BR HZ	0	M	0.0	0.01	29.39	30.02	11.9	22	12.7	37	220	29	230	27
28	74	48	61	M	46	54	4	0	-	-		0	M	0.0	0.00	29.51	30.17	6.1	28	8.3	29	260	24	280	28
29	76	44	60	M	47	54	5	0	-	-		0	M	0.0	0.00	29.63	30.27	1.6	08	3.2	13	030	12	330	29
30	86	52	69	M	52	60	0	4	-	-		0	M	0.0	0.00	29.54	30.16	5.1	20	5.7	16	240	14	220	30
31	85	62	74*	M	59	65	0	9	-	-	HZ	0	M	0.0	0.00	29.45	30.07	5.0	21	5.7	18	210	16	220	31
	M	M	M		42.7	51.0	8.3	1.0	<-----Monthly Averages | Totals----->			M	M	0.84	M	M	0.5	23	7.7	<Monthly Average					
	M	M	M	<----------Departure From Normal---------->									M												

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	249	M	M	M
Cooling:	31	M		

Greatest 24-hr Precipitation: M Date: M
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level Pressure	Date	Time (LST)
Maximum M	M	M
Minimum M	M	M

Number of Days with -------->
Max Temp >=90: M
Max Temp <=32: M
Thunderstorms : 4

Min Temp <=32: M
Min Temp <=0 : M
Heavy Fog : 0

Precipitation >=.01 inch: M
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 06/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	80	64	72	M	61	65	0	7	-	-	BR HZ	0	M	0.0	T	29.38	29.99	3.8	20	4.6	14	270	12	280	01
02	87	62	75	M	62	67	0	10	-	-	BR HZ	0	M	0.0	0.00	29.25	29.85	7.0	20	7.3	18	200	14	220	02
03	83	64	74	M	64	66	0	9	-	-	TS TSRA RA BR HZ	0	M	0.0	0.83	29.06	29.66	1.6	17	4.9	30	170	23	180	03
04	73	62	68	M	62	63	0	3	-	-	RA BR HZ	0	M	0.0	0.08	28.84	29.43	5.8	20	8.1	17	220	15	220	04
05	66	43	55	M	49	52	10	0	-	-	RA BR HZ	0	M	0.0	0.03	28.88	29.56	10.4	26	13.8	35	260	26	270	05
06	62	43*	53*	M	42	48	12	0	-	-		0	M	0.0	0.00	29.29	29.95	5.0	25	7.8	22	280	18	290	06
07	85	46	66	M	52	59	0	1	-	-		0	M	0.0	0.00	29.28	29.88	9.6	17	10.5	23	180	18	190	07
08	88	58	73	M	62	67	0	8	-	-	TSRA	0	M	0.0	0.07	29.15	29.79	12.8	22	15.3	49s	290	43	290	08
09	72	48	60	M	47	54	5	0	-	-		0	M	0.0	0.00	29.44	30.08	5.1	35	6.9	20	010	15	360	09
10	76	48	62	M	47	55	3	0	-	-	BR	0	M	0.0	0.00	29.46	30.09	2.6	33	4.8	18	310	15	320	10
11	81	51	66	M	50	58	0	1	-	-	BR	0	M	0.0	0.00	29.47	30.11	4.6	33	5.6	17	320	15	320	11
12	88	57	73	M	55	63	0	8	-	-		0	M	0.0	0.00	29.47	30.09	4.3	33	5.0	18	340	14	340	12
13	87	60	74	M	57	64	0	9	-	-	BR	0	M	0.0	0.00	29.41	30.04	4.2	06	6.9	25	090	22	090	13
14	80	56	68	M	52	59	0	3	-	-		0	M	0.0	0.00	29.44	30.06	7.4	07	8.2	22	040	18	040	14
15	81	54	68	M	52	59	0	3	-	-		0	M	0.0	0.00	29.42	30.05	2.4	01	3.7	16	350	13	360	15
16	82	59	71	M	56	62	0	6	-	-		0	M	0.0	0.00	29.36	29.98	9.0	21	9.2	22	230	20	240	16
17	85	65	75	M	59	65	0	10	-	-		0	M	0.0	T	29.31	29.93	3.3	27	7.8	17	340	15	350	17
18	88	58	73	M	60	66	0	8	-	-	BR	0	M	0.0	0.00	29.36	29.97	4.1	19	5.4	17	160	14	140	18
19	88	63	76	M	64	68	0	11	-	-	RA BR HZ	0	M	0.0	0.69	29.24	29.85	11.8	21	13.9	64	230	51	230	19
20	73	56	65	M	48	56	0	0	-	-		0	M	0.0	0.00	29.38	M	11.1	29	M	28	310	23	310	20
21	82	58	70	M	53	60	0	5	-	-		0	M	0.0	T	29.30	29.91	10.5	27	13.8	35	300	29	300	21
22	70	55	63	M	44	53	2	0	-	-		0	M	0.0	0.00	29.37	30.00	12.8	33	13.2	32	330	25	310	22
23	73	48	61	M	43	52	4	0	-	-		0	M	0.0	0.00	29.39	30.02	5.6	29	8.6	23	320	18	310	23
24	82	58	70	M	52	60	0	5	-	-		0	M	0.0	0.00	29.41	30.04	7.3	22	7.6	21	230	15	240	24
25	85	60	73	M	60	65	0	8	-	-		0	M	0.0	0.00	29.49	30.13	7.0	21	7.4	21	230	15	190	25
26	92*	66	79	M	65	70	0	14	-	-	BR HZ	0	M	0.0	0.00	29.54	30.15	8.1	21	8.4	21	210	18	200	26
27	89	72	81*	M	67	71	0	16	-	-	HZ	0	M	0.0	T	29.38	29.97	13.2	22	13.5	33	220	26	220	27
28	83	62	73	M	57	63	0	8	-	-		0	M	0.0	T	29.33	29.96	8.5	32	10.3	22	350	18	340	28
29	76	57	67	M	46	56	0	2	-	-		0	M	0.0	0.00	29.44	30.07	4.4	36	7.2	18	330	15	350	29
30	79	53	66	M	47	56	0	1	-	-	RA	0	M	0.0	T	29.41	30.05	7.0	32	8.3	26	340	22	330	30
	80.4	58.6	69.5		54.5	60.7	1.2	5.2	<-----Monthly Averages | Totals----->			M	M	T	29.41	30.03	3.5	25	8.6	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	36	M	M	M
Cooling:	156	M		

Greatest 24-hr Precipitation: T Date: M
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level Pressure		Date	Time (LST)
Maximum	30.20	26	1011
Minimum	29.83	21	1344

Number of Days with -------->
Max Temp >=90: 1
Max Temp <=32: 0
Thunderstorms : 3
Min Temp <=32: 0
Min Temp <=0 : 0
Heavy Fog : 0
Precipitation >=.01 inch: 0s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 07/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	69	52	61*	M	45	53	4	0	-	-		0	M	0.0	0.00	29.54	30.19	8.5	35	8.9	24	010	16	340	01
02	74	49*	62	M	46	54	3	0	-	-		0	M	0.0	0.00	29.63	30.27	4.7	34	6.4	21	010	17	020	02
03	79	50	65	M	46	56	0	0	-	-		0	M	0.0	0.00	29.54	30.15	2.2	18	5.4	18	250	15	210	03
04	67	59	63	M	59	61	2	0	-	-	RA BR HZ	0	M	0.0	0.37	29.31	29.92	5.4	18	6.2	26	210	22	200	04
05	80	59	70	M	63	65	0	5	-	-	TS RA FG+ FG BR	0	M	0.0	0.12	29.23	29.86	4.0	21	5.0	23	350	20	330	05
06	81	60	71	M	60	64	0	6	-	-	BR	0	M	0.0	0.00	29.28	29.91	4.3	25	6.4	20	210	17	210	06
07	83	61	72	M	56	63	0	7	-	-		0	M	0.0	0.00	29.28	29.88	10.9	22	11.2	26	220	23	220	07
08	81	67	74	M	65	69	0	9	-	-	RA HZ	0	M	0.0	0.01	29.13	29.75	12.3	22	12.7	28	230	23	230	08
09	89	69	79	M	69	73	0	14	-	-	TS HZ	0	M	0.0	0.00	29.15	29.78	13.6	22	14.1	31	230	24	210	09
10	92*	67	80*	M	66	71	0	15	-	-	BR HZ	0	M	0.0	0.00	29.21	29.81	8.8	20	9.6	24	200	20	210	10
11	79	56	68	M	59	64	0	3	-	-	TS RA	0	M	0.0	0.30	29.10	29.73	10.6	26	13.6	28	310	24	300	11
12	79	51	65	M	54	59	0	0	-	-	TS TSRA RA	0	M	0.0	T	29.23	29.85	9.6	22	10.3	37	220	30	230	12
13	74	55	65	M	53	58	0	0	-	-	TSRA RA	0	M	0.0	0.01	29.26	29.90	7.3	26	9.1	25	280	21	290	13
14	77	50	64	M	55	59	1	0	-	-	RA	0	M	0.0	0.30	29.21	29.82	8.1	20	9.3	33	230	29	230	14
15	75	59	67	M	57	60	0	2	-	-		M	M	M	T	29.18	29.82	8.6	25	10.5	23	220	18	220	15
16	77	59	68	M	59	62	0	3	-	-	RA HZ	0	M	0.0	0.05	29.33	29.97	3.5	22	4.9	15	330	14	320	16
17	78	58	68	M	60	63	0	3	-	-	RA	0	M	0.0	T	29.38	29.99	6.5	19	6.9	20	220	15	220	17
18	80	64	72	M	62	66	0	7	-	-	BR HZ	0	M	0.0	T	29.28	29.89	4.7	21	6.0	21	190	17	200	18
19	82	60	71	M	65	67	0	6	-	-	TS TSRA RA DZ BR	0	M	0.0	1.46	29.07	29.67	3.8	25	8.0	45	310	35	330	19
20	74	57	66	M	52	58	0	1	-	-		0	M	0.0	0.00	29.26	29.94	11.5	31	12.1	24	310	20	310	20
21	78	53	66	M	50	58	0	1	-	-		0	M	0.0	0.00	29.52	30.17	6.0	35	6.8	20	010	16	350	21
22	82	55	69	M	51	60	0	4	-	-		0	M	0.0	0.00	29.60	30.23	5.4	02	6.3	18	040	15	020	22
23	80	57	69	M	55	60	0	4	-	-	RA	0	M	0.0	0.10	29.52	30.14	3.0	09	4.2	12	100	10	100	23
24	76	61	69	M	59	62	0	4	-	-		0	M	0.0	0.01	29.44	30.07	4.0	22	5.2	15	230	13	210	24
25	82	61	72	M	60	64	0	7	-	-	BR HZ	0	M	0.0	0.00	29.45	30.08	2.9	14	5.1	18	170	14	200	25
26	84	63	74	M	63	66	0	9	-	-	RA BR HZ	0	M	0.0	0.02	29.41	30.02	5.1	19	6.4	18	200	15	230	26
27	80	64	72	M	65	67	0	7	-	-	TS RA BR	0	M	0.0	0.10	29.25	29.86	5.6	19	6.4	20	240	16	200	27
28	83	63	73	M	64	68	0	8	-	-	BR HZ	0	M	0.0	0.00	29.23	29.87	2.2	33	5.4	16	350	13	020	28
29	85	64	75	M	61	66	0	10	-	-	BR HZ	0	M	0.0	0.00	29.34	29.96	6.8	05	7.1	21	030	18	030	29
30	85	57	71	M	54	62	0	6	-	-		0	M	0.0	0.00	29.36	29.99	1.8	02	3.5	17	330	13	010	30
31	90	62	76	M	59	66	0	11	-	-		0	M	0.0	0.00	29.37	29.98	5.0	23	6.0	17	210	15	210	31
	79.8	58.8	69.3		57.8	62.7	0.3	4.9	<-----Monthly Averages | Totals----->			M	M	2.87s	29.33	29.95	3.5	23	7.7	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	10	M	M	M
Cooling:	152	M		

Greatest 24-hr Precipitation: 1.46 Date: 19
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

	Sea Level Pressure	Date	Time (LST)
Maximum	30.33	02	0750
Minimum	29.61	19	1507

Number of Days with -------->
Max Temp >=90: 2
Max Temp <=32: 0
Thunderstorms : 9
Min Temp <=32: 0
Min Temp <=0 : 0
Heavy Fog : 1
Precipitation >=.01 inch: 12
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 08/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC Depth	1800 UTC Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	max 5-second Dir	max 2-minute Speed	max 2-minute Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	92	65	79	M	64	69	0	14	-	-	BR	0	M	0.0	0.00	29.36	29.97	2.1	21	3.0	14	210	12	210	01
02	94*	69	82*	M	66	71	0	17	-	-	BR HZ	0	M	0.0	0.00	29.34	29.95	9.1	21	9.5	22	220	17	230	02
03	91	64	78	M	66	70	0	13	-	-	TS TSRA GR RA HZ	0	M	T	0.93	29.29	29.91	7.1	23	9.1	47	280	38	280	03
04	80	58	69	M	54	61	0	4	-	-		0	M	0.0	0.00	29.41	30.04	3.7	36	5.1	22	020	14	350	04
05	87	54	71	M	57	63	0	6	-	-	BR	0	M	0.0	0.00	29.34	29.93	5.1	18	7.1	24	220	21	210	05
06	85	69	77	M	70	72	0	12	-	-	BR HZ	0	M	0.0	T	29.16	29.79	7.3	23	9.3	23	200	18	200	06
07	79	62	71	M	68	70	0	6	-	-	RA FG+ FG BR HZ	0	M	0.0	0.14	29.21	29.80	5.2	19	6.5	23	180	20	190	07
08	88	69	79	M	67	71	0	14	-	-	BR	0	M	0.0	0.00	29.13	29.75	9.8	29	11.8	25	300	22	310	08
09	76	66	71	M	63	65	0	6	-	-	RA	0	M	0.0	0.02	29.25	29.87	6.8	07	7.8	20	090	17	090	09
10	81	64	73	M	57	63	0	8	-	-		0	M	0.0	0.00	29.24	29.88	5.6	36	6.2	20	330	16	330	10
11	85	60	73	M	57	63	0	8	-	-		0	M	0.0	0.00	29.39	30.03	1.7	01	3.6	20	320	15	320	11
12	85	64	75	M	65	68	0	10	-	-	RA BR	0	M	0.0	0.29	29.39	30.01	6.2	23	7.7	25	290	21	290	12
13	80	61	71	M	54	61	0	6	-	-	BR	0	M	0.0	0.00	29.36	29.99	6.5	32	8.9	21	270	17	280	13
14	78	53	66	M	54	59	0	1	-	-		0	M	0.0	0.00	29.34	29.95	7.4	21	8.1	22	210	18	210	14
15	79	65	72	M	58	64	0	7	-	-	RA	0	M	0.0	T	29.26	29.90	8.6	26	10.8	24	210	18	290	15
16	85	57	71	M	60	65	0	6	-	-	TSRA RA	0	M	0.0	0.03	29.23	29.85	6.3	24	10.1	28	310	22	300	16
17	79	54	67	M	46	56	0	2	-	-	TS	0	M	0.0	T	29.29	29.94	8.8	29	12.0	38	310	32	300	17
18	69	50*	60	M	47	54	5	0	-	-		0	M	0.0	0.00	29.57	30.21	5.2	30	7.3	20	350	16	350	18
19	72	54	63	M	50	56	2	0	-	-		0	M	0.0	0.00	29.51	30.14	2.5	01	4.0	15	350	13	350	19
20	64	54	59*	M	51	55	6	0	-	-	RA	0	M	0.0	0.03	29.49	30.12	11.0	08	11.3	24	090	18	090	20
21	68	59	64	M	56	59	1	0	-	-	RA BR	0	M	0.0	0.02	29.41	30.04	9.8	10	10.1	21	100	16	090	21
22	79	62	71	M	62	65	0	6	-	-	RA BR	0	M	0.0	0.06	29.41	30.05	1.8	14	4.1	17	130	14	130	22
23	80	66	73	M	69	71	0	8	-	-	TS TSRA RA BR HZ	0	M	0.0	0.10	29.34	29.94	11.0	19	11.4	28	210	23	210	23
24	89	73	81	M	66	71	0	16	-	-	RA BR VCTS	0	M	0.0	T	29.23	29.83	12.8	21	13.5	43	230	32	220	24
25	83	62	73	M	67	69	0	8	-	-	RA	0	M	0.0	0.01	29.17	29.79	12.6	23	13.8	37	220	29	230	25
26	79	57	68	M	57	61	0	3	-	-		0	M	0.0	0.01s	29.39	30.04	2.9	32	5.5	17	350	13	350	26
27	83	56	70	M	58	62	0	5	-	-	BR	0	M	0.0	0.00	29.52	30.15	3.0	03	4.8	17	350	14	010	27
28	86	57	72	M	59	64	0	7	-	-		0	M	0.0	0.00	29.48	30.10	5.9	20	6.7	18	200	15	200	28
29	90	66	78	M	63	68	0	13	-	-	BR HZ	0	M	0.0	0.00	29.39	30.00	9.6	20	9.8	23	210	18	210	29
30	73	56	65	M	61	63	0	0	-	-		0	M	0.0	0.00	29.41	30.04	6.3	35	6.8	18	350	15	350	30
31	78	52	65	M	50	57	0	0	-	-		0	M	0.0	0.00	29.47	30.12	6.5	36	7.3	21	020	17	340	31
	81.2	60.6	70.9		59.4	64.1	0.5	6.6	<-----Monthly Averages | Totals----->			M	M	1.63s		29.35	29.97	2.4	24	8.2	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	14	M	M	M
Cooling:	206	M		

Greatest 24-hr Precipitation: 0.93 Date: 03
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

	Sea Level Pressure	Date	Time (LST)
Maximum	30.28	18	1144
Minimum	29.66	08	0342

Number of Days with -------->
Max Temp >=90: 4
Max Temp <=32: 0
Thunderstorms : 6
Min Temp <=32: 0
Min Temp <=0 : 0
Heavy Fog : 1
Precipitation >=.01 inch: 10s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 09/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	74	53	64	M	47	55	1	0	-	-		0	M	0.0	0.00	29.60	30.25	5.6	04	6.3	23	010	20	010	01
02	80	45	63	M	47	55	2	0	-	-		0	M	0.0	0.00	29.58	30.19	3.0	20	4.7	9s	220	8s	200	02
03	85	59	72	M	58	64	0	7	-	-		0	M	0.0	0.00	29.40	30.02	8.3	23	9.2	25	260	18	210	03
04	75	54	65	M	55	59	0	0	-	-	RA	0	M	0.0	T	29.42	30.06	1.9	03	3.7	14	320	12	350	04
05	85	60	73	M	59	64	0	8	-	-	RA BR	0	M	0.0	0.05	29.44	30.07	4.5	09	6.0	15	090	13	080	05
06	92*	61	77	M	61	67	0	12	-	-	BR HZ	0	M	0.0	0.00	29.45	30.07	7.5	20	7.9	24	200	20	220	06
07	90	73	82*	M	64	70	0	17	-	-	RA HZ	0	M	0.0	0.03	29.36	29.95	15.6	20	16.0	40	220	32	220	07
08	80	64	72	M	61	66	0	7	-	-	RA BR	0	M	0.0	T	29.38	30.01	3.4	30	8.5	26	230	22	250	08
09	68	62	65	M	62	62	0	0	-	-	RA BR	0	M	0.0	1.34	29.39	30.02	8.5	06	9.0	18	050	15	060	09
10	75	59	67	M	57	61	0	2	-	-		0	M	0.0	0.00	29.41	30.01	3.8	06	4.6	14	010	10	040	10
11	71	53	62	M	55	59	3	0	-	-	RA BR	0	M	0.0	0.33	29.07	29.68	9.7	26	12.1	51	300	43	290	11
12	68	52	60	M	50	54	5	0	-	-		0	M	0.0	T	29.32	30.00	12.0	25	12.6	24	260	21	280	12
13	73	47	60	M	50	54	5	0	-	-		0	M	0.0	0.00	29.51	30.13	3.5	18	4.2	17	170	16	160	13
14	81	52	67	M	54	59	0	2	-	-	TSRA RA BR	0	M	0.0	0.26	29.25	29.87	10.2	22	13.6	38	220	31	220	14
15	58	46	52	M	43	48	13	0	-	-	RA	0	M	0.0	T	29.45	30.13	10.8	30	11.5	25	290	22	310	15
16	64	40	52*	M	39	46	13	0	-	-		0	M	0.0	0.00	29.65	30.31	3.5	21	4.7	24	270	17	190	16
17	71	40*	56	M	43	49	9	0	-	-		0	M	0.0	0.00	29.70	30.36	2.1	09	4.5	18	140	14	340	17
18	75	45	60	M	46	53	5	0	-	-	BR	0	M	0.0	0.00	29.67	30.30	1.3	17	2.7	12	170	9	230	18
19	79	53	66	M	54	59	0	1	-	-		0	M	0.0	0.00	29.54	30.17	8.3	19	8.5	17	230	15	230	19
20	78	59	69	M	58	62	0	4	-	-	BR HZ	0	M	0.0	0.00	29.52	30.15	3.5	02	5.5	16	350	13	360	20
21	83	56	70	M	59	63	0	5	-	-	BR HZ	0	M	0.0	0.00	29.44	30.04	4.5	21	5.1	17	220	15	200	21
22	79	56	68	M	54	61	0	3	-	-		0	M	0.0	0.00	29.34	29.98	7.8	25	12.0	29	240	24	240	22
23	75	47	61	M	44	52	4	0	-	-		0	M	0.0	0.00	29.62	30.26	2.8	02	3.5	16	020	13	020	23
24	80	45	63	M	48	55	2	0	-	-		0	M	0.0	0.00	29.55	30.17	5.0	21	6.3	18	220	16	220	24
25	87	58	73	M	62	67	0	8	-	-	TSRA RA VCTS	0	M	0.0	0.32	29.36	29.97	12.3	21	12.7	33	220	28	220	25
26	73	65	69	M	66	67	0	4	-	-	RA DZ	0	M	0.0	0.30	29.31	29.94	6.6	22	8.1	26	210	21	220	26
27	66	53	60	M	57	58	5	0	-	-	RA DZ BR	0	M	0.0	0.39	29.31	29.94	4.4	36	4.9	15	360	13	350	27
28	69	51	60	M	51	54	5	0	-	-	RA FG+ BR	0	M	0.0	0.02	29.33	30.00	9.9	28	11.3	32	290	28	300	28
29	67	48	58	M	48	52	7	0	-	-	BR	0	M	0.0	0.00	29.70	30.37	3.3	31	5.2	15	290	12	310	29
30	73	47	60	M	49	54	5	0	-	-		0	M	0.0	0.00	29.74	30.37	5.4	17	5.9	17	180	14	190	30
	75.8	53.4	64.6		53.4	58.3	2.8	2.7	<-----Monthly Averages | Totals----->			M	M	3.06s		29.46	30.09	3.0	23	7.7	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	84	M	M	M
Cooling:	80	M		

Greatest 24-hr Precipitation: 1.34 Date: 09
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

	Sea Level Pressure	Date	Time (LST)
Maximum	30.45	30	0831
Minimum	29.58	11	1400

Number of Days with -------->
Max Temp >=90: 2
Max Temp <=32: 0
Thunderstorms : 2
Min Temp <=32: 0
Min Temp <=0 : 0
Heavy Fog : 1
Precipitation >=.01 inch: 11s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 10/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	79	56	68	M	51	58	0	3	-	-		0	M	0.0	0.00	29.60	30.23	9.7	18	10.0	23	220	20	210	01
02	70	60	65	M	57	60	0	0	-	-	RA BR	0	M	0.0	0.14	29.51	30.12	9.2	17	9.9	21	190	18	190	02
03	75	58	67	M	59	62	0	2	-	-	FG+ BR	0	M	0.0	0.00	29.34	29.98	14.2	20	14.7	35	230	28	230	03
04	77	57	67	M	57	61	0	2	-	-	FG+ FG BR HZ	0	M	0.0	0.00	29.52	30.17	0.9	14	2.9	12	030	10	030	04
05	85*	54	70	M	60	63	0	5	-	-	BR	M	M	M	0.01s	29.58	30.21	0.4	32	1.6	10	200	8	200	05
06	80	62	71	M	66	67	0	6	-	-	TSRA RA BR	0	M	0.0	0.66	29.47	30.09	5.9	21	7.2	23	310	17	300	06
07	72	59	66	M	63	64	0	1	-	-	DZ FG+ FG BR	0	M	0.0	0.05	29.46	30.09	1.9	07	3.4	17	090	15	090	07
08	84	62	73*	M	67	69	0	8	-	-	BR	0	M	0.0	0.00	29.31	29.91	8.7	22	9.2	21	260	16	220	08
09	73	52	63	M	61	62	2	0	-	-	FG+ FG BR HZ	0	M	0.0	0.12	29.18	29.78	3.6	25	6.6	21	250	17	250	09
10	61	48	55	M	47	51	10	0	-	-		0	M	0.0	0.00	29.08	29.71	8.1	23	10.1	28	220	22	220	10
11	61	44	53	M	45	49	12	0	-	-		0	M	0.0	T	29.10	29.75	7.3	32	8.8	24	340	20	340	11
12	53	39	46	M	36		19	0	-	-		0	M	0.0	0.00	29.23	M	10.1	31	11.4	23	350	20	350	12
13	57	38	48	M	35	43	17	0	-	-		0	M	0.0	0.00	29.28	29.93	13.2	25	13.7	32	250	26	250	13
14	56	43	50	M	43	47	15	0	-	-		0	M	0.0	0.00	29.44	30.11	6.7	27	6.9	17	270	15	280	14
15	60	41	51	M	46	48	14	0	-	-	RA	0	M	0.0	T	29.54	30.20	0.8	03	2.1	12	020	9	010	15
16	62	47	55	M	46	50	10	0	-	-	RA	0	M	0.0	0.01	29.50	30.14	8.7	08	8.9	21	090	15	070	16
17	70	51	61	M	55	57	4	0	-	-	FG+ BR HZ	0	M	0.0	T	29.39	30.02	3.7	21	4.9	17	210	15	210	17
18	75	49	62	M	58	60	3	0	-	-	RA FG+ BR HZ	0	M	0.0	0.02	29.18	29.77	5.0	16	5.8	17	170	15	180	18
19	73	60	67	M	58	62	0	2	-	-	RA VCTS	0	M	0.0	0.11	28.87	29.47	12.1	20	15.1	36	250	28	240	19
20	65	55	60	M	47	53	5	0	-	-		0	M	0.0	0.00	29.02	29.69	16.0	24	16.1	36	250	29	250	20
21	76	55	66	M	46	55	0	1	-	-		0	M	0.0	0.00	29.36	30.00	13.1	20	13.4	31	230	26	210	21
22	76	56	66	M	48	56	0	1	-	-	RA	0	M	0.0	T	29.39	30.00	10.5	20	10.7	24	200	20	210	22
23	67	47	57	M	51	52	8	0	-	-	RA DZ BR	0	M	0.0	0.69	29.13	29.77	4.1	30	7.0	24	310	21	310	23
24	60	44	52	M	43	47	13	0	-	-	BR	0	M	0.0	0.00	29.31	30.00	4.3	28	4.9	17	270	13	260	24
25	60	43	52	M	44	47	13	0	-	-		0	M	0.0	0.00	29.67	30.33	8.4	05	9.2	21	060	17	060	25
26	60	39	50	M	47	49	15	0	-	-	RA BR	0	M	0.0	0.08	29.62	30.24	4.3	08	5.0	12	090	10	090	26
27	60	43	52	M	50	52	13	0	-	-	RA	0	M	0.0	0.05	29.33	30.00	14.1	24	16.8	43	270	33	280	27
28	49	32	41*	M	32	37	24	0	-	-	RA	0	M	0.0	T	29.77	30.46	9.6	29	10.4	26	290	23	290	28
29	56	28*	42	M	34	40	23	0	-	-		0	M	0.0	0.00	29.77	30.42	10.3	23	11.3	31	230	25	230	29
30	60	38	49	M	40	45	16	0	-	-	BR	0	M	0.0	0.00	29.67	30.32	8.1	21	8.8	23	210	18	220	30
31	65	47	56	M	39	48	9	0	-	-	RA BR	0	M	0.0	0.11	29.42	30.03	14.2	21	15.6	51	260	37	260	31
	67.0	48.6	57.8		49.4	53.8	7.9	1.0	<-----Monthly Averages | Totals----->			M	M	2.02s	29.39	30.03	4.9	22	9.1	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	245	M	M	M
Cooling:	31	M		

Greatest 24-hr Precipitation: 0.67s Date: 23
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level Pressure		Date	Time (LST)
Maximum	30.55	29	0224
Minimum	29.39	19	1554

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 0
Thunderstorms : 1
Min Temp <=32: 2
Min Temp <=0 : 0
Heavy Fog : 6
Precipitation >=.01 inch: 11s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 11/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC Depth	1800 UTC Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	max 5-second Dir	max 2-minute Speed	max 2-minute Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	52	32	42	M	35	41	23	0	-	-	RA BR	0	M	0.0	0.11	29.43	30.13	9.8	27	10.9	26	290	22	310	01
02	53	27	40	M	31	36	25	0	-	-	MIFG BR	0	M	0.0	0.00	29.68	30.34	3.2	08	3.9	15	100	13	100	02
03	55	28	42	M	34	39	23	0	-	-	BR	0	M	0.0	0.00	29.41	30.05	3.7	29	5.2	17	310	15	300	03
04	51	35	43	M	33	38	22	0	-	-		0	M	0.0	0.00	29.24	29.90	8.4	26	8.9	21	260	17	270	04
05	51	27	39	M	36	39	26	0	-	-	RA	0	M	0.0	0.26	29.15	29.77	8.6	18	10.2	36	220	28	210	05
06	46	36	41	M	31	37	24	0	-	-	RA	0	M	0.0	T	29.00	29.69	18.5	25	19.3	38	240	31	240	06
07	44s	33	M	M	25	32	M	M	-	-	SN	0	M	T	T	29.44	30.15	12.4	28	12.9	28	290	22	290	07
08	42	30	36	M	30	34	29	0	-	-	RA DZ SN	0	M	T	T	29.49	30.15	5.1	15	6.4	18	140	14	170	08
09	46	35	41	M	31	36	24	0	-	-	RA DZ BR	0	M	0.0	0.01	29.36	30.03	7.1	11	8.4	16	090	14	100	09
10	42	26	34	M	32	34	31	0	-	-	RA DZ BR	0	M	0.0	T	29.51	30.20	5.5	05	6.0	17	050	15	050	10
11	48	23	36	M	29	34	29	0	-	-	RA FG+ FZFG BR	0	M	0.0	0.05	29.59	30.26	4.5	15	5.2	16	150	14	160	11
12	55	41	48	M	45	47	17	0	-	-	DZ BR HZ	0	M	0.0	0.01	29.39	30.02	8.1	20	11.5	29	210	24	210	12
13	54	34	44	M	39	43	21	0	-	-	BR	0	M	0.0	0.00	29.34	29.99	4.4	24	7.5	21	300	16	310	13
14	60*	34s	M	M	47	50	M	M	-	-	RA BR HZ	0	M	0.0	0.03	29.02	29.65	12.3	21	14.0	41	210	36	210	14
15	51	38	45	M	35	40	20	0	-	-	RA	0	M	0.0	0.03	29.00	29.67	12.7	29	13.6	30	300	24	300	15
16	39	33	36	M	26	32	29	0	-	-	SN BR	0	M	T	0.01	29.21	29.89	14.3	29	14.8	29	270	24	320	16
17	37	27	32	M	25	30	33	0	-	-	SN	0	M	T	T	29.36	30.07	1.1	28	5.6	22	300	20	280	17
18	44	22	33	M	25	30	32	0	-	-		0	M	0.0	0.00	29.65	30.36	7.3	06	7.6	21	050	18	050	18
19	44	25	35	M	29	34	30	0	-	-	RA	0	M	0.0	T	29.64	30.27	7.6	15	8.9	29	180	23	180	19
20	53	42	48*	M	43	45	17	0	-	-	RA DZ BR	0	M	0.0	0.30	29.31	29.98	3.3	25	11.0	28	180	21	180	20
21	44s	38	M	M			M	M	-	-	BR UP	0	M	0.0	1.29	29.25	M	M	M	12.0	30	050	24	060	21
22	38	25	32	M	28	30	33	0	-	-	RA SN PL FZFG BR	T	M	0.7	0.45	29.22	29.93	11.3	36	15.7	30	030	25	030	22
23	27	16	22*	M	17	21	43	0	-	-	SN	T	M	T	T	29.62	30.33	6.9	31	7.1	18	320	16	310	23
24	36	14*	25	M	23	26	40	0	-	-	SN BR	T	M	0.1	0.01	29.67	30.34	8.2	20	9.0	29	240	24	210	24
25	42	30	36	M	29	34	29	0	-	-	RA SN	T	M	T	0.10	29.52	30.18	12.8	22	13.6	33	210	26	220	25
26	42	36	39	M	38	39	26	0	-	-	RA DZ BR	0	M	0.0	0.34	29.28	29.92	2.5	35	6.7	28	020	22	020	26
27	42	29	36	M	28	32	29	0	-	-	RA SN BR	0	M	T	0.06	29.31	30.03	18.6	25	19.3	47	290	40	280	27
28	41s	22s	M	M			M	M	-	-		M	M	M	0.00	29.66	M	M	M	7.7	16s	110	13s	120	28
29	44	26	35	M			30	0	-	-	SN	0	M	T	0.18	M	M	M	M	M	43	240	36	240	29
30	41	22	32	M	19	26	33	0	-	-	SN BLSN	0	M	T	0.01	29.49	30.19	17.0	25	18.6	53	240	44	240	30
	42.5	24.0	33.3		M	M	M	M	<-----Monthly Averages | Totals----->				M	M	T	M	M	4.6	25	10.4	<Monthly Average			
	M	M	M	<----------Departure From Normal---------->									M												

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	M	M		M
Cooling:	M	M	M	M

Greatest 24-hr Precipitation: T Date: M
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

	Sea Level Pressure	Date	Time (LST)
Maximum	30.34	30	2358
Minimum	30.00	30	1323

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 0s
Thunderstorms : 0
Min Temp <=32: 2s
Min Temp <=0 : 0
Heavy Fog : 1
Precipitation >=.01 inch: 0s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA

(final)

NOAA, National Climatic Data Center

Month: 12/2007

Station Location: NIAGARA FALLS INTL AIRPORT (04724)
NIAGARA FALLS , NY
Lat. 43.107 Lon. -78.945
Elevation(Ground): 585 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC	1800 UTC	2400 LST	2400 LST	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second		max 2-minute		
												Depth	Water Equiv	Snow Fall	Water Equiv						Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	24s	17	M	M	11	17	M	M	-	-	SN BR	T	M	0.8	0.01	29.84	30.56	2.6	36	12.1	31	260	24	260	01
02	40	16	28	M	28	29	37	0	-	-	RA DZ SN FZFG BR UP	5	M	5.4	0.63	29.39	29.98	8.2	12	10.0	26	090	22	140	02
03	44	26	35	M	24	29	30	0	-	-	RA SN BR	T	M	0.1	0.20	28.95	29.66	22.9	27	24.1	47	270	38	280	03
04	30	22	26	M	16	23	39	0	-	-	SN BR	T	M	0.2s	T	29.10	29.78	17.6	29	18.4	36	310	28	300	04
05	23	11	17	M	13	17	48	0	-	-	SN BR	1	M	0.4	0.01	29.17	29.89	6.0	32	7.9	20	340	14	320	05
06	28	13	21	M	14	20	44	0	-	-	SN	T	M	T	T	29.52	30.23	8.9	25	10.6	23	260	21	270	06
07	33	24	29	M	22	27	36	0	-	-	SN BR	T	M	T	T	29.49	30.16	8.2	22	10.3	22	190	18	180	07
08	35	23	29	M	21	27	36	0	-	-		T	M	0.0	0.00	29.60	30.32	11.1	26	11.7	25	280	20	300	08
09	30	26	28	M	23	26	37	0	-	-	SN BR	T	M	0.1	0.01	29.72	30.39	4.8	07	5.4	15	090	13	090	09
10	34	22	28	M	27	28	37	0	-	-	SN FZFG BR	T	M	0.1	0.01	29.62	30.32	1.1	33	1.8	8	360	7	010	10
11	37	22	30	M	31	32	35	0	-	-	RA DZ BR	0	M	0.0	0.43	29.52	30.15	2.2	14	4.2	16	260	13	260	11
12	36	19	28	M	25	29	37	0	-	-	SN BR	1	M	2.2	0.35	29.47	30.20	9.0	28	9.9	26	320	22	320	12
13	36	19	28	M	26	27	37	0	-	-	DZ SN FG+ FZFG BR	1	M	3.9	0.21	29.40	30.05	3.3	13	9.8	30	240	24	240	13
14	36	17	27	M	22	27	38	0	-	-	SN GS	3	M	T	T	29.47	30.22	14.1	27	17.6	35	240	28	240	14
15	20	10*	15*	M	9	15	50	0	-	-	SN BR	2	M	0.7	0.07	29.72	30.37	11.3	07	11.6	26	090	22	090	15
16	26	16	21	M	18	20	44	0	-	-	FZRA SN FG+ FZFG BR UP BLSN	4	M	11.8	0.73	28.85	29.50	9.0	02	17.4	35	300	30	340	16
17	27	11	19	M	17	21	46	0	-	-	SN BR UP	12	M	0.3s	T	29.31	30.06	13.4	27	14.8	38	310	30	310	17
18	33	22	28	M	24	28	37	0	-	-	BR HZ	12	M	T	T	29.54	30.21	13.5	20	13.9	30	200	24	220	18
19	37	30	34	M	28	32	31	0	-	-	RA DZ SN PL BR	9	M	T	0.01	29.34	30.02	9.4	22	11.5	21	240	17	250	19
20	34	28	31	M	27	30	34	0	-	-	SN BR HZ	6	M	T	T	29.52	30.22	3.4	34	8.3	17	270	15	270	20
21	40	20	30	M	23	27	35	0	-	-	BR HZ	6	M	0.0	0.00	29.59	30.28	6.6	09	7.0	15	110	13	120	21
22	43	24	34	M	31	35	31	0	-	-	BR HZ	5	M	0.0	T	29.57	30.25	8.4	16	8.6	30	160	23	160	22
23	51*	25	38	M	35	38	27	0	-	-	RA SN BR HZ BLSN	2	M	0.4	0.67	29.13	29.76	15.6	20	20.2	54	230	43	230	23
24	30	25	28	M	22	26	37	0	-	-	SN FZFG BR BLSN	4	M	3.7	0.20	29.21	29.92	21.0	24	21.5	41	230	37	240	24
25	34	29	32	M	26	29	33	0	-	-	BR HZ	2	M	0.0	0.00	29.54	30.24	9.6	24	10.1	22	250	18	220	25
26	35	29	32	M	29	31	33	0	-	-	BR HZ	2	M	0.0	0.00	29.51	30.17	1.8	07	6.9	16	090	13	090	26
27	37	30	34	M	31	33	31	0	-	-	RA DZ SN BR	1	M	T	0.06	29.30	29.98	6.6	22	11.9	24	250	21	220	27
28	43	29	36	M	30	33	29	0	-	-	RA BR	T	M	0.0	0.16	29.48	30.12	4.1	15	10.0	33	220	25	210	28
29	43	33	38*	M	30	34	27	0	-	-	SN	T	M	T	0.02	29.26	29.98	19.0	23	19.1	44	230	35	230	29
30	33	30	32	M	24	29	33	0	-	-	SN BR	T	M	0.3	0.03	29.41	30.06	0.3	09	5.5	18	270	15	230	30
31	33	25	29	M	27	29	36	0	-	-	SN BR	1	M	0.8	0.06	29.26	29.95	4.5	25	8.3	24	230	20	230	31
	34.4	22.4	28.4		23.7	27.4	36.2	0.0	<-----Monthly Averages | Totals----->			M	33.2s	3.92s	29.41	30.10	4.7	24	11.6	<Monthly Average				
	M	M	M	<----------Departure From Normal---------->								M													

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	1085	M	M	M
Cooling:	0	M		

Greatest 24-hr Precipitation: 0.73 Date: 11-12
Greatest 24-hr Snowfall: 1.2 Date: 16
Greatest Snow Depth: 14s Date: 17

Sea Level Pressure	Date	Time (LST)
Maximum 30.68	01	1055
Minimum 29.18	16	1443

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 9
Thunderstorms : 0
Min Temp <=32: 30
Min Temp <=0 : 0
Heavy Fog : 2
Precipitation >=.01 inch: 20s
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

*** EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.**

Data Version: VER2

From: Janet Fisher [mailto:nrcc@cornell.edu]
Sent: Tuesday, April 22, 2008 1:13 PM
To: Spector, Harold L LRB
Subject: Re: Info request

Harold,

In response to your e-mail inquiry:

Can you please provide me with the year 2007 average annual temperature 48.3 deg. F
and total precipitation 29.21 inches
at Niagara Falls Airport, NY?

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Northeast Regional Climate Center Phone: 607 255-1751
1123 Bradfield Hall Fax: 607 255-2106
Cornell University E-mail: nrcc@cornell.edu
Ithaca NY 14853 http://nrcc.cornell.edu
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