

Decommissioning Plan
Fort Mims Site
Maryland Heights, Missouri

U.S. Nuclear Regulatory Commission
Radioactive Materials License No. 24-16273-01

Prepared for:

Sigma-Aldrich Manufacturing, LLC
PO Box 14508
St. Louis, MO 63178

Prepared by:



Decontamination Decommissioning and Environmental Services, LLC
4 Arrow Dr
Woburn, MA 01832

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1.1 DEFINITIONS

Action level - The numerical value that will cause the decision maker to choose one of the alternative actions. It may be a regulatory threshold standard (e.g., Maximum Contaminant Level for drinking water), a dose- or risk-based concentration level (e.g., DCGL), or a reference-based standard. See investigation level.

ALARA (acronym for As Low As Reasonably Achievable) - A basic concept of radiation protection which specifies that exposure to ionizing radiation and releases of radioactive materials should be managed to reduce collective doses as far below regulatory limits as is reasonably achievable considering economic, technological, and societal factors, among others. Reducing exposure at a site to ALARA strikes a balance between what is possible through additional planning and management, remediation, and the use of additional resources to achieve a lower collective dose level. A determination of ALARA is a site-specific analysis that is open to interpretation because it depends on approaches or circumstances that may differ between regulatory agencies. An ALARA recommendation should not be interpreted as a set limit or level.

Area factor (A_m) - A factor used to adjust $DCGL_W$ to estimate $DCGL_{EMC}$ and the minimum detectable concentration for scanning surveys in Class 1 survey units— $DCGL_{EMC} = DCGL_W \bullet A_m$. A_m is the magnitude by which the residual radioactivity in a small area of elevated activity can exceed the $DCGL_W$ while maintaining compliance with the release criteria.

Arithmetic standard deviation - A statistic used to quantify the variability of a set of data. It is calculated in the following manner: 1) subtracting the arithmetic mean from each data value individually, 2) squaring the differences, 3) summing the squares of the differences, 4) dividing the sum of the squared differences by the total number of data values less one, and 5) taking the square root of the quotient. The calculation process produces the Root Mean Square Deviation (RMSD).

Assessment - The evaluation process used to measure the performance or effectiveness of a system and its elements. As used in MARSSIM, assessment is an all-inclusive term used to denote



any of the following: Audit, performance evaluation, management systems review, peer review, inspection, or surveillance.

Background radiation - Radiation from cosmic sources and naturally occurring radioactive material

Calibration - Comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Chain of custody - An unbroken trail of accountability that ensures the physical security of samples, data, and records.

Characterization survey - A type of survey that includes facility or site sampling, monitoring, and analysis activities to determine the extent and nature of contamination. Characterization surveys provide the basis for acquiring necessary technical information to develop, analyze, and select appropriate cleanup techniques.

CHP - Certified Health Physicist

CIH - Certified Industrial Hygienist

Class 1 survey - A type of final status survey that applies to areas with the highest potential for contamination, and meets the following criteria: (1) impacted; (2) potential for delivering a dose above the release criterion; (3) potential for small areas of elevated activity; and (4) insufficient evidence to support classification as Class 2 or Class 3.

Class 2 survey - A type of final status survey that applies to areas that meet the following criteria: (1) impacted; (2) low potential for delivering a dose above the release criterion; and (3) little or no potential for small areas of elevated activity.

Class 3 survey - A type of final status survey that applies to areas that meet the following criteria: (1) impacted; (2) little or no potential for delivering a dose above the release criterion; and (3) little or no potential for small areas of elevated activity.



Composite sample - A sample formed by collecting several samples and combining them (or selected portions of them) into a new sample which is then thoroughly mixed.

Confidence interval - A range of values for which there is a specified probability (e.g., 90%, 95%) that this set contains the true value of an estimated parameter.

Contamination - The presence of residual radioactivity in excess of levels which are acceptable for release of a site or facility for unrestricted use.

DAC - Derived Air Concentration

DCGL (derived concentration guideline level) - A derived, radionuclide-specific activity concentration within a survey unit corresponding to the release criterion. The DCGL is based on the spatial distribution of the contaminant and hence is derived differently for the nonparametric statistical test (DCGL_W) and the Elevated Measurement Comparison (DCGL_{EMC}). DCGLs are derived from activity/dose relationships through various exposure pathway scenarios.

Decommissioning - The process of removing a facility or site from operation, followed by decontamination, and license termination (or termination of authorization for operation) if appropriate. The objective of decommissioning is to reduce the residual radioactivity in structures, materials, soils, ground water, and other media at the site so that the concentration of each radionuclide contaminant that contributes to residual radioactivity is indistinguishable from the background radiation concentration for that radionuclide.

Decontamination - The removal of radiological contaminants from a person, object or area to within levels established by governing regulatory agencies. Decontamination is sometimes used interchangeably with remediation, remedial action, and cleanup.

Derived concentration guideline level - See DCGL.

Detection limit - The net response level that can be expected to be seen with a detector with a fixed level of certainty.

Detection sensitivity - The minimum level of ability to identify the presence of radiation or radioactivity.



Distribution coefficient (Kd) - The ratio of elemental (i.e., radionuclide) concentration in soil to that in water in a soil-water system at equilibrium. Kd is generally measured in terms of gram weights of soil and volumes of water (g/cm^3 or g/ml).

Exposure pathway - The route by which radioactivity travels through the environment to eventually cause a person or a group to be exposed to radiation.

Final status survey - Measurements and sampling to describe the radiological conditions of a site, following completion of decontamination activities (if any) in preparation for release.

FSS - Final status survey

Gamma radiation - Penetrating high-energy, short-wavelength electromagnetic radiation (similar to X-rays) emitted

Half-life ($t_{1/2}$) - The time required for one-half of the atoms of a particular radionuclide present to disintegrate.

HASP - Health and Safety Plan

Hypothesis - An assumption about a property or characteristic of a set of data under study. The goal of statistical inference is to decide which of two complementary hypotheses is likely to be true. The null hypothesis (H_0) describes what is assumed to be the true state of nature and the alternative hypothesis (H_a) describes the opposite situation.

Impacted area - Any area that is not classified as non-impacted. Areas with a possibility of containing residual radioactivity in excess of natural background or fallout levels.

Infiltration rate - The rate at which a quantity of a substance moves from one environmental medium to another (e.g., the rate at which a quantity of rainwater moves into and through a volume of soil).

Investigation level - A derived media-specific, radionuclide-specific concentration or activity level of radioactivity that - 1) is based on the release criterion, and 2) triggers a response, such as further investigation or cleanup, if exceeded. See action level.



License - A license issued under the regulations in parts 30 through 35, 39, 40, 60, 61, 70 or part 72 of 10 CFR.

License termination - Discontinuation of a license, the eventual conclusion to decommissioning.

MARSSIM - Multi-Agency Radiation Survey and Site Investigation Manual

MDA - Minimum detectable activity

Minimum detectable concentration (MDC) - A *priori* activity level that a specific instrument and technique can be expected to detect 95% of the time. When stating the detection capability of an instrument, this value should be used. The MDC is the detection limit, LD, multiplied by an appropriate conversion factor to give units of activity.

Minimum detectable count rate (MDCR) - The minimum detectable count rate (MDCR) is the *a priori* count rate that a specific instrument and technique can be expected to detect.

Non-impacted area - Areas where there is no reasonable possibility (extremely low probability) of residual contamination. Non-impacted areas are typically located off-site and may be used as background reference areas.

NRC - United States Nuclear Regulatory Commission

NVLAP - National Voluntary Laboratory Accreditation Program

OSHA - Occupational Safety and Health Administration

QAPP - Quality Assurance Project Plan

QA/QC - Quality Assurance/Quality Control

Quality assurance (QA) - An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality control (QC) - The overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify that they meet the



stated requirements established by the customer, operational techniques and activities that are used to fulfill requirements for quality.

Radioactivity - The mean number of nuclear transformations occurring in a given quantity of radioactive material per unit time. The International System (SI) unit of radioactivity is the Becquerel (Bq). The standard unit is the Curie (Ci).

Radiological survey - Measurements of radiation levels and radioactivity associated with a site together with appropriate documentation and data evaluation.

Radionuclide - An unstable nuclide that undergoes radioactive decay.

Release criterion - A regulatory limit expressed in terms of dose or risk.

Remedial action - Those actions that are consistent with a permanent remedy taken instead of, or in addition to, removal action in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment.

Representative measurement - A measurement that is selected using a procedure in such a way that it, in combination with other representative measurements, will give an accurate representation of the phenomenon being studied.

RESRAD - A computer code used to determine residual radioactivity in the environment by analysis of various exposure pathways.

Sample - A part or selection from a medium located in a survey unit or reference area that represents the quality or quantity of a given parameter or nature of the whole area or unit; a portion serving as a specimen.

Site - Any installation, facility, or discrete, physically separate parcel of land, or any building or structure or portion thereof, that is being considered for survey and investigation.



Soil activity (soil concentration) - The level of radioactivity present in soil and expressed in units of activity per soil mass (typically Bq/kg or pCi/g).

Source term - All residual radioactivity remaining at the site, including material released during normal operations, inadvertent releases, or accidents, and that which may have been buried at the site in accordance with 10 CFR Part 20.

Subsurface soil sample - A soil sample that reflects the modeling assumptions used to develop the DCGL for subsurface soil activity. An example would be soil taken deeper than 15 cm below the soil surface to support surveys performed to demonstrate compliance with 40 CFR 192.

Surface soil sample - A soil sample that reflects the modeling assumptions used to develop the DCGL for surface soil activity. An example would be soil taken from the first 15 cm of surface soil to support surveys performed to demonstrate compliance with 40 CFR 192.

Survey - A systematic evaluation and documentation of radiological measurements with a correctly calibrated instrument or instruments that meet the sensitivity required by the objective of the evaluation.

Survey plan - A plan for determining the radiological characteristics of a site.

Survey unit - A geographical area of specified size and shape defined for the purpose of survey design and compliance testing.

TDS - Total Dissolved Solids

TEDE (total effective dose equivalent) - The sum of the effective dose equivalent (for external exposure) and the committed effective dose equivalent (for internal exposure). TEDE is expressed in units of Sv or rem.



1.0 INTRODUCTION

The Fort Mims Site (FMS) is an open land site in Maryland Heights, Missouri. This three (3) acre parcel of land was once used by Sigma-Aldrich Manufacturing, LLC (Sigma) for the manufacture of radiolabeled chemical compounds. All structures and utilities were removed from the site in 2010. Sigma currently holds Nuclear Regulatory (NRC) License No. 24-16273-01 which allows for the possession, transfer and disposal of source material from decommissioning operations.

This Decommissioning Plan (DP) is designed to comply with the requirements of the License Termination Rule (LTR), Subpart E of Title 10 of the Code of Federal Regulations (CFR) Part 20.1402 "Radiological Criteria for Unrestricted Use." This DP and the chapters therein are organized similar to the organization of Chapters 16 to 18 of NUREG-1757, Vol. 1. This approach was selected in order to facilitate regulatory review of the DP. The contents of each chapter were compared to a checklist of chapter-specific acceptance criteria derived from Chapter 16, Appendix D of NUREG-1757.

This DP describes the remedial actions that will be implemented and defines the site-specific radiological release criteria that will be used to terminate Sigma's Radioactive Materials License No. 24-16273-01 issued by the NRC. Radioactive materials historically used at the Fort Mims Site consisted of tritium (^3H) and carbon (^{14}C). Other radionuclides including Chlorine-36, Phosphorous-32, Phosphorous-33, Selenium-75, and S-35 were licensed but never used at the Fort Mims Site. The following is the name and address of the licensee and owner of the Fort Mims Site:

Sigma-Aldrich Manufacturing, LLC.

PO Box 14508

St. Louis, MO 63178

This plan was developed using the guidance provided in NUREG 1757, "Consolidated NMSS Decommissioning Guidance" and NUREG 1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM). It provides the approach, methods, and techniques for the evaluation of radiologically impacted land areas at the site. RESRAD Version 7.2 for site specific dose modeling was used to establish derived concentration guideline levels for ^3H and ^{14}C in soils.



These methods ensure technically defensible data is generated to aid in determining whether or not these facilities meet the release criteria for unrestricted use specified in 10 CFR 20 Subpart E of 25 mrem/year.

1.1 Summary and History of Licensed Activities

The NRC approved the licensee's Fort Mims Site as an approved location of use on November 11, 1974. The NRC issued license no. 24-16273-01 to Pathfinder Laboratories authorizing the possession of carbon-14 and hydrogen-3 for synthesis of labeled compounds for commercial distribution at the Fort Mims Facility. On July 22, 1987, the NRC issued Amendment No. 08 to License 24-16273-01, changing the licensee name and ownership of the Fort Mims Site from Pathfinder Laboratories to Sigma Chemical Company. NRC License Amendment 15, dated March 13, 2002, changed the name from Sigma Chemical Company to Sigma-Aldrich Manufacturing LLC. Sigma continued to produce custom compounds labeled with ^3H or ^{14}C until mid-year 2008, at which time Sigma notified the NRC of its intent to cease operations and begin decommissioning the site per the approved Sigma-Aldrich Manufacturing, LLC Fort Mims Site Decontamination and Decommissioning Plan (ML083010187) dated October 20, 2008. The 20,000 square foot facility was decommissioned in accordance with the approved DP and the facility was removed from the radioactive material license. The structures, foundation and abandoned septic system of the production facility were removed from the site in 2010. Site soils were evaluated in compliance with the approved Open Land Soil Sampling and Analysis Plan dated October 20, 2008. The results indicated surface soils had nuclide concentrations in a number of locations above the default screening values listed in Table B.2 of NUREG-1757, Vol.1, Rev.2 for the isotopes of concern. Another four phases of soil sampling were performed to define the horizontal and vertical extents of contamination onsite and on the southern abutting property. Shallow groundwater onsite was also evaluated and found to contain detectable levels of ^{14}C and ^3H . Based on these results the site was upgraded to a Group 5 Decommissioning under NUREG 1757, "Consolidated NMSS Decommissioning Guidance."



1.2 Site Description

The Fort Mims Facility is approximately 3.3 miles east southeast of Maryland Heights and 16 miles west of the city center of the City of St. Louis, Missouri. The population of the cities of Maryland Heights and St. Louis are approximately 26,000 and 356,000, respectively. The Facility is bordered by commercial and light industrial property in all directions. Nearby are Interstates 70 to the north, 270 to the west, 170 to the east, and 44 to the south. The current land use in the area is primarily industrial and commercial built according to a heavily planned urban design. There is very little open or undeveloped land in the vicinity of the site. Residential use of the Sigma site in the near future is considered unlikely due to local zoning restrictions. The facility was constructed in two phases beginning in the late 1960s. Sigma-Aldrich Manufacturing, LLC expanded the original Pathfinder building in 1981 to its final configuration.

The only effluent discharge points were via a facility exhaust stack and a septic tank. The use of the septic system stopped in July 1981 when the facility was connected to the Metropolitan St. Louis Sewer district. The abandoned septic tank was discovered during the demolition of the concrete floor of a building addition.

1.3 Radiological Status of the Facility

Chapter 4 of the DP provides detailed information on the radiological status of the Fort Mims Site, including levels of radioactivity at various locations, radionuclide concentrations in ground water, surface soils and subsurface soils.

1.4 Dose Modeling

In Chapter 5 of the DP, a site conceptual model is described and used to show potential pathways for human exposure to the radioactive materials present at the Fort Mims Site. The likely future use scenarios for the FMS are industrial worker and suburban resident. These scenarios were used in determining potential radiation doses to humans from site contaminants.

The radiation dose potentials for these scenarios were determined using RESRAD Onsite Version 7.2 computer-based modeling tools designed specifically to assess exposures to residual radioactivity from a variety of pathways. Several pathways contribute to the exposure potential under these exposure scenarios, including direct radiation exposure, inhalation and ingestion. Of



these, there are only two that are key to the decommissioning, exposure from inhalation or ingestion of contaminated soils and ingestion of contaminated ground water.

1.5 Planned Decommissioning Activities

The site has been under evaluation since 2009. Both soils and groundwater have been studied to determine what potential impacts the remaining ^{14}C and ^3H contamination could have on a potentially exposed member of the public. We believe contamination onsite was generated from two different pathways. The data suggests that air effluent discharges from the local exhaust ventilation system were deposited on the property for many years. The second pathway is thought to be from use of a septic system during the early operation of the synthesis facility. The horizontal and vertical extents of soils contamination from both pathways have been fully characterized. Further, groundwater both on and off-site has been fully characterized as well.

Highly conservative site-specific dose modeling was used to establish Derived Concentration Guideline Levels (DCGLs) for potential future uses at the site. Comparison of these levels with the characterization data indicates current concentrations of radiological contaminants meet the requirements in 10 CFR 20.1402 for unrestricted release of the facility.



2.0 FACILITY OPERATING HISTORY

2.1 License Number, Status and Authorized Activities

The Fort Mims Site currently operates under U.S. Nuclear Regulatory Commission Radioactive Materials License Number 24-16273-01. Current license conditions are provided in Table 2-1.

Table 2-1 —Current License Conditions

Isotope	Physical Form
Hydrogen-3	Residual Contamination
Carbon-14	Residual Contamination

The current license conditions allow for radioactive material possession incident to decommissioning activities as described in “Sigma-Aldrich Fort Mims Facility, Maryland Heights, Decontamination and Decommissioning Plan” dated October 2008.

2.2 License History

The Fort Mims Site operates under U.S. Nuclear Regulatory Commission Radioactive Materials License Number 24-16273-01. Radioactive materials usage at the site currently consists of residual contamination in soils. Amendment #18 was approved January 12, 2010 which limited the authorized use of radioactive materials to decommissioning activities as described in “Sigma-Aldrich Fort Mims Facility, Maryland Heights, Decontamination and Decommissioning Plan” dated October 2008.

2.3 Previous Decommissioning Activities

In 2008, Sigma contracted a private firm to commence the decommissioning of the Fort Mims Site. The main building structures were decontaminated, decommissioned, and contaminated building components removed from site. All radioactive waste was sent to Toxco Materials Management Center in Oak Ridge, Tennessee for processing and disposal. The 20,000 square foot facility was decommissioned in accordance with the approved DP and the facility was removed from the radioactive material license. The structures, foundation and abandoned septic system of the production facility were removed from the site in 2010.

A total of five soil sampling campaigns were performed to delineate the horizontal and vertical extents of soil contamination both on and offsite. During demolition of the concrete foundations, a septic tank was located under the former footprint of the building. Sampling of the adjacent soils indicated



the presence of licensed material. It is possible that disposal of radioactive material in the septic system could have occurred sometime between 1975 and 1981 when the septic system was abandoned, and the facility switched to municipal sewer. Interestingly, the highest levels of soils contamination were not found near the septic system but along the south wall footing to the building. It is believed that stack effluent emissions from local exhaust settled on the roof of the facility and were washed off into the soil by natural rainfall. This is backed up by the fact that the highest level of contaminants were found nearest the gutter downspouts.

While no soils contamination was identified near the water table, onsite groundwater monitoring wells were installed to determine if groundwater had been impacted by past site operations in 2016. Both ^{14}C and ^3H were identified in groundwater at levels below the US Environmental Protection Agency (EPA) primary drinking water standards. Offsite monitoring wells were then installed in 2017 and sampled to confirm offsite groundwater levels were below the primary drinking water standard. The groundwater has been monitored once a quarter for over a year. While groundwater from this aquifer is not of sufficient quality to be used for drinking or irrigation, the groundwater pathway was added to the site-specific RESRAD dose model as a conservative measure.

2.4 Spills

Minor spills were documented during the site's operational history inside the operational areas of the facility. These areas were successfully decontaminated to levels below 2,200 dpm/100cm² for removable contamination. There were no documented spills or releases of radioactive material exterior of the building.

2.5 Prior On-site Burials

Solid radioactive materials were never buried on site during the history of the license. However, liquid radioactive materials may have been disposed of through septic system prior to 1981.



3.0 FACILITY DESCRIPTION

The following sections give a description of the site's physical, geological, and civil characteristics.

3.1 Site Location and Description

Residences are not located in the immediate vicinity of the property. Fort Mims Drive is a private street with the Fort Mims Site being the only property on the road. Fort Mims Drive is accessed from Lakeside Crossing Court. The FMS is surrounded by commercial and industrial buildings as part of a large industrial complex. The nearest structure is a commercial building located west of the site. To the north is Lakeside Crossing Court. The zoning of the area is strictly commercial and industrial in nature. Fort Mims Drive goes uphill in a southward direction from Lakeside Crossing Court making the view of the site partially obstructed. There are natural visual barriers in place at the site as well. To the south and east there are tree lines.

3.2 Current/Future Land Use

Current land use in the general vicinity of the site is a mixture of offices, light manufacturing and warehouse operations. The site is part of a large industrial park development. It is unlikely that use of this area will change in the near future. The only other plausible future use of the site could be a suburban dweller if the zoning of the site changed in the future, and if the site was developed into a condominium complex.

3.3 Climate

The average annual temperature and rainfall in the area are 57.0 degrees Fahrenheit and 40.92 inches, respectively.¹ The prevailing winds are generally from the south and southeast in the spring, south or northwest in the summer, the south or northwest in the fall, and the northwest in the winter.²

3.4 Soil

The Web Soil Survey for the Fort Mims Site, prepared by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) was reviewed to further assess soils in the area. The site has been mapped with two primary soil types: Urban Land-Harvester Complex, and Urban Land Upland. The soil parent material is a loess. The soil profile is

¹ http://nowdata.rcc-acis.org/LSX/pubACIS_results (1981-2010).

² http://www.windfinder.com/windstats/windstatistic_st_louis_lambert_airport.htm (July 2009 - July 2013).



generally comprised of silt loam, underlain by silty clay loam and clay loam. Natural drainage class: Moderately well drained.

3.5 Seismology

The site is in a region of the country that has a seismic risk due to the presence of the New Madrid Seismic Zone (NMSZ) in southeastern Missouri and the Wabash Valley Seismic Zone (WVSZ) in southeastern Illinois and southwestern Indiana. The NMSZ is the site of three of the largest magnitude earthquake events (estimated surface-wave magnitudes greater than or equal to 8.0) to strike North America in recorded history (December 1811 through February 1812). Researchers predict that the WVSZ is capable of producing large earthquakes similar in magnitude to the 1811-1812 NMSZ earthquakes.

3.6 Geologic Characteristics of the Site and Surrounding Area

According to the Geologic Map of Missouri, the site is underlain by stratified sequences of shale and limestone of the Des Moines Series of the Pennsylvanian System in the Paleozoic Era. The Missouri Department of Natural Resources geologic map for the area indicates that the site is located near the boundary between the Pennsylvanian age Cherokee Group, which is comprised mainly of shale, siltstone, coal, and sandstone and the Mississippian age St. Genevieve limestone. A historic water well log reported near the site indicates limestone bedrock is present. Based on site boring logs, surficial soils on top of bedrock are mostly silty clay (CL) and clayey silt (ML) with soil thickness ranging from approximately 33 feet to 50 feet.

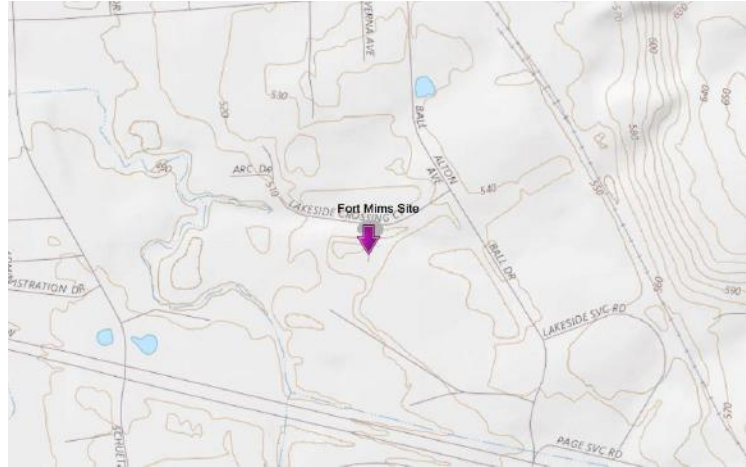
3.7 Surface Water Hydrology

3.7.1 Site Drainage and Fluvial Features

According to the USGS topographic map and site observations, surface water generally flows toward the west and an unnamed tributary to Fee Fee Creek. Fee Fee Creek flows into the Missouri River approximately four miles to the northwest of the site.

3.7.2 Topographic Maps

Topography in the area of the FMS are shown on the USGS as shown in Figure 3-1. Local surface water features, manmade and natural drainage features and drainage areas are indicated.



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Figure 3-2
Fort Mims Site 2017



Figure 3-3
Fort Mims Site 2008



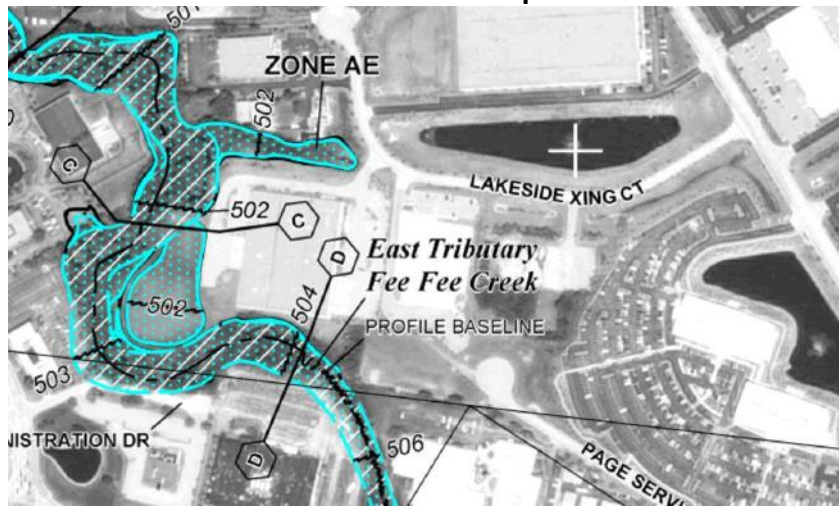
3.7.4 100-Year Floodplain

Delineated flood hazard areas in the vicinity of the FMS, as mapped on Federal Emergency Management Agency (FEMA) flood insurance rate maps are presented as Figure 3-4. A special



flood hazard area inundated by the 100-year flood plain has been identified along Fee Fee Creek but does not come near the site boundaries.

Figure 3-4
FEMA Flood Map



3.8 Ground Water Hydrology

3.8.1 Saturated Zone

Groundwater elevation data collected from shallow monitoring wells installed at the site indicates that the shallow groundwater flow direction is mainly towards the west. Saturation in soil on the site property occurs at depths generally ranging from 15-20 feet below ground surface. The depth to groundwater is less than ten feet below ground surface at off-site properties to the west of the site.

Water wells in this area are required by Missouri state regulations to include approximately 80 feet of surface casing. Groundwater shallower than approximately 80 feet cannot be used for domestic purposes.

3.8.2 Monitoring Wells

Four (4) onsite monitoring wells were installed in early 2016 to evaluate groundwater contamination levels at less than 35 feet in depth. The onsite wells are MW-2, MW-3, MW-4 and MW-1 serves as the background reference. The results indicated that ¹⁴C and



^3H were detectable in shallow groundwater at levels below the secondary drinking water standards. Four (4) offsite monitoring wells were installed downgradient of the site in early 2017 to evaluate groundwater flow direction, elevation, and evaluate potential offsite contamination levels. The offsite wells are MW-5, MW-6, MW-7, and MW-8. Boring Logs and sample results for all wells have been included as Appendix A. The FMS monitoring well locations are shown in Figure 3-5 and recent groundwater level elevation contour maps are provided in Appendix B.

Figure 3-5
FMS Monitoring Well Locations



3.8.3 Ground Water Flow Directions

Groundwater elevation data collected from shallow monitoring wells installed both onsite and offsite at the site indicates that the shallow groundwater flow direction is mainly towards the west. Appendix B presents the groundwater elevation contour maps.



3.9 Natural Resources

There are no known mineral, fuel, hydrocarbon or other similar-type natural resources in the areas surrounding the facility. Much of the surrounding area includes industrial and light industrial operations.

3.10 Potable, Agricultural, or Industrial Ground or Surface Waters

Ground water classification and use in the vicinity of the FMS is described as; Shallow ground water in this area is not suitable potable, agricultural, or industrial use.



4.0 RADIOLOGICAL STATUS OF THE SITE

4.1 Surface and Subsurface Soil Exposure Rates and Activity

Dose rates from residual ^{14}C and ^3H contamination is unlikely to be measurable due to their low energy beta emissions being shielded by the surrounding media. Gamma exposure readings confirmed this in the field. Both impacted and unimpacted areas had the same gamma exposure rates.

4.2 Soil Sampling Methodology

Sampling methods were performed in accordance with the approved *Phase 4 – Soil Sampling and Analysis Plan Sigma-Aldrich Fort Mims Site Maryland Heights, Missouri* report (dated February 26, 2015) (Sampling Plan). Soils samples were collected using hand augers and Geo-Probe or similar machinery. The sampling equipment was decontaminated after each use to prevent cross-contamination of samples. A minimum of 500 grams of soils were collected from each location and depth interval. The sample was transferred into a stainless-steel bowl and thoroughly homogenized. After homogenizing, the sample is transferred to the appropriate labeled container for off-site radiological analysis.

Sample ID

Each sample point was designated by a Sample ID, and identified as follows: WWW: 2-character designation of survey unit (for example, “030”)

XXX: 2-character designation of sample location (for example, “107”)

YY: 2-character designation of sample type (for example, “01” = ^{14}C and “02” = ^3H)

For example, in the sample identification number, 30-107-01, “30” represents the survey unit, “107” represents the location and “01” represents the sample type of ^{14}C . The sample ID number was recorded on the containers and chain-of-custody record at the time of sample collection.

Sample Shipment and Analysis

All samples were packaged and controlled in accordance with the Plan. The samples were controlled using chain-of custody procedures custody seals and the use of field logbooks during collection.



The soil samples were driven to Test America Laboratories in Earth City, Missouri. Total ^{14}C and total ^3H concentrations were determined by oxidation analysis. Test America is accredited by the National Environmental Laboratory Accreditation Program (NELAP) and is licensed to receive and analyze radioactive material.

Sampling Quality Assurance

Quality assurance samples will be collected for statistical analysis. For precision, one (1) field duplicate was obtained for every ten (10) samples collected. A field duplicate is a duplicate sample collected from the same sample point which has been thoroughly homogenized.

4.3 Surface Soil Contamination

4.3.1 Open Soils Areas

The areas to the south and west of the former building footprint have been identified as having the highest concentrations of contamination present. A total of three hundred thirty-nine (339) discrete soil samples were obtained from the upper four (4) meters of soils with the majority of samples coming from the first six (6) inches of soil. This includes 15 duplicate samples for quality control. This work was performed as part of the approved Phase 4 Soil Sampling Plan dated February 26, 2015. As a result of Phase 4 sampling, four (4) offsite location were sampled to further delineate surface concentrations of carbon-14 (^{14}C) and tritium (^3H). In the event that a sample location exceeds the DCGL for ^{14}C of 401 pCi/g an Elevated Measurement Comparison (EMC) dose assessment using RESRAD version 7.2 will be performed to determine the potential dose. Only the area of contamination will be adjusted based on the distances between adjacent sample locations, all other site-specific RESRAD parameters will remained unchanged.

4.3.2 Subsurface Soil Contamination

The old septic system was removed after the building was demolished but the exact location of the leachate field could not be determined. It was not found on any site drawing or plans that were available during the preparation of this document. However, prior to connecting to the municipal sewer system in 1981, the septic system served all sinks onsite including laboratories.



Since the facility operated as a custom compound synthesis laboratory, any number of compounds could have been labeled with ^{14}C and ^3H . The molecular composition of the labeled compound would then drive solubility and mobility of the radioactive material in environmental media.

4.4 Distribution of Radionuclides in Groundwater

Table 4-1 and 4-2 summarize all the groundwater results for ^{14}C and ^3H , respectively. Micro-purge low flow sampling was performed due to the slow recharge rates found at the FMS for shallow groundwater. Samples were filtered using a 0.45-micron pore size filter to remove suspended particulates. The samples were sent to TestAmerica Laboratories, Inc. in Earth City, Missouri for liquid scintillation analysis. Both ^{14}C and ^3H analysis included a special preparatory step to capture any volatile portion of the sample. A comprehensive Groundwater Monitoring Report for the FMS has been included as Appendix C.

Table 4-1 Fort Mims Quarterly ^{14}C Groundwater Monitoring Results

Date Sampled	05/20/16	09/19/16	12/29/16	01/09/17	04/10/17	7/6/17
Well Location	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)
GW01	<5.20*	<6.20*	19.4	NS	56.8	17.1
GW02	101	51.4	118	NS	126	125
GW03	Dry	105	647	NS	632	505
GW04	63.5	32.8	86.9	NS	83.4	47.9
GW05	NS	NS	NS	27.1	33.0	28.5
GW06	NS	NS	NS	11.8	20.0	10.9
GW07	NS	NS	NS	<11.8*	<10.4*	<5.4*
GW08	NS	NS	NS	<11.6*	<10.5*	<5.3*

* – ½ the detection limit was used for sample results that were less than the detection limit for the analytical method.



Table 4-2 Fort Mims Quarterly ³H Groundwater Monitoring Results

Date Sampled	05/20/16	09/19/16	12/29/16	01/09/17	04/10/17	7/6/17
Well ID#	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)	Results (pCi/L)
GW01	1,530	6,980	5,780	NS	3,640	4,520
GW02	13,500	12,500	12,600	NS	8,100	11,000
GW03	Dry	1,150	1,230	NS	759	1,260
GW04	9,400	7,390	7,580	NS	8,220	8,770
GW05	NS	NS	NS	7,980	7,260	6,960
GW06	NS	NS	NS	6,110	5,310	5,130
GW07	NS	NS	NS	3,030	4,360	3,770
GW08	NS	NS	NS	4,080	3,690	650

* – ½ the detection limit was used for sample results that were less than the detection limit for the analytical method.

These values indicate dissolved ¹⁴C and ³H is present in groundwater at levels below the US EPA established Maximum Contaminant Level (MCL) of 4 millirem per year (mrem/year) for beta particle and photon radioactivity from man-made radionuclides in drinking water. The average concentration of ¹⁴C or ³H which would yield 4 millirem per year is 2,000 picocuries (pCi/L) and 20,000 pCi/L, respectively. Adding the contributions from both nuclides with a Sum of the Fractions Unity Rule type calculation would still not exceed the 4 mrem/yr limit.



5.0 SITE-SPECIFIC DOSE MODELING

An important aspect of the DP is to assess what the potential radiation dose could result to a potential receptor from the remaining residual radioactivity after decommissioning activities have been completed. For dose modeling and assessment purposes, the FMS and southern abutting property will be treated as a single land area.

“A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 millirem (0.25 mSv) per year, including that from ground water, sources of drinking water, and the residual radioactivity has been reduced to levels that are As Low As Reasonably Achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.”

To decommission the FMS, a radiation dose objective of 25 millirem above background has been selected as the basis for demonstrating that the property may be released for unrestricted use.

The NRC has developed guidance on acceptable approaches and methodologies for radiation dose modeling to demonstrate compliance with the 25 millirem limit. Sigma has thus selected the scenarios and critical population groups, developed the source term, selected exposure pathways and calculated Derived Concentration Guideline Levels (DCGLs) in accordance with NUREG-1757.

The following subsections contain a description of the methodology used to perform the dose assessments, a detailed description of the site conceptual model that includes the source term used as input to the assessment, and the exposure scenarios deemed reasonably likely.

5.1 Assessment Methodology

Assessing the radiation dose at the FMS post decommissioning involves preparing a site conceptual model which includes defining the source(s), identifying potential receptors, identifying the pathways of exposure, and determining the duration of exposure. RESRAD Onsite



Version 7.2 was used to model radionuclide fate and transport of residual radioactivity and to assess the radiation dose incurred by hypothetical receptors. This code provides an estimate of the annual radiation dose beginning immediately and extending for 1,000 years into the future. This dose modeling software is widely-accepted as an industry-standard tool for performing radiological dose assessments and for deriving site specific DCGLs.

There are several important features of the RESRAD code that should be taken into account in interpreting any results that are generated through its use. These are;

- The radiation dose conversion factors (DCFs) used by RESRAD are taken from Federal Guidance Reports (FGRs) No. 13, which are derived from a dosimetry model promulgated by the International Commission on Radiation Protection (ICRP) Publication 107 (2008);
- Short-lived radioactive progeny (e.g. half-life less than 180 days) are accounted for using the "parent+D" DCFs;
- RESRAD integrates and normalizes exposure factors based on the fraction of time a receptor is exposed over the exposure period; and
- RESRAD uses single-point estimates for values of every parameter to evaluate complete pathways in the deterministic module of the code.

The deterministic approach was used for the FMS. It is designed to capture the reasonable maximum exposure condition for a receptor using single point estimates of parameter values.

Because the NRC has established its decision-making criteria on the use of probabilistic assessment methods and the resulting reasonably foreseeable exposure to an average member of the critical exposure group. This methodology is also recommended in NUREG-1757.

5.2 Site Conceptual Model

The site conceptual model defines the relationship between the residual radioactivity onsite, the transport mechanisms, the exposure routes, and how the human receptor interacts with the



site. The site conceptual model has three fundamental components that must be described in order to calculate the potential future dose to a human receptor;

1. Source term
2. Physical characteristics of the site
3. Plausible exposure scenarios

Each of these fundamental components is described in the subsections that follow.

5.2.1 Source Term

The source term is defined primarily by the distribution of contaminant(s) at the site moderated by site specific parameters such as mass, volume, density, mobility in soils and/or groundwater. The source term for the FMS is the residual radioactivity that will remain in the surface soil and groundwater after decommissioning which will be less than the bounding limit of 25 millirem total effective dose equivalent (TEDE) for a critical group.

5.2.2 Site Physical Parameters

The important physical, hydraulic, and geological conditions of the FMS have been input based on site-specific data. This leads to a more accurate calculation than if the default parameters were used. The RESRAD computer model uses information about the physical characteristics of the site to estimate the migration potential for radionuclides and the ultimate distribution of the radioactive materials in the receptor exposure pathways over the course of 1,000 years. For simplicity, the conceptual site model is comprised of three layers. These layers are:

- Contaminated Zone Layer – Surface to three (3) meters in depth;
- Unsaturated Uncontaminated Zone Layer – From three (3) meters to ten (10) meters
- Saturated Zone Layer - The saturated at a depth of ten (10) meters

The following subsections describe these layers as they relate to the FMS.

5.2.2.1 The Contaminated Zone Layer



The Contaminated Zone Layer is comprised of residual radioactivity contained in the first three (3) meters of soils. The Contaminated Zone covers 4,200 m² of area with no cover present to limit a potential receptor's contact with the radioactivity. It is important to note that 80% of the detectible contamination found onsite is contained in the upper six (6) inches of soil. It has been deposited over a wide area from a single point exhaust stack on the west side of the former production facility. The second source of contamination is thought to be from the use of a septic system for a number of years until closure in 1981 when the facility was connected to the city sewer system. Deeper contaminated soils occupy a smaller area, approximately 800 m², extending from six inches in depth to three (3) meters. There appear to be two sources of soils contamination at the FMS. Airborne radioactive particulate is thought to have been deposited over a wide area from a single point exhaust stack on the west side of the former production facility. The second source of contamination is thought to be from the use of a septic system for a number of years until closure in 1981 when the facility was connected to the city sewer system.

5.2.2.2 Unsaturated Uncontaminated Zone Layer

Soils contamination extend to a depth of three (3) meters below ground surface at the FMS. The unsaturated uncontaminated zone layer extends from a depth of three (3) to six (6) meters. The soil at this depth ranges from brown silty clay to silt.

5.2.2.3 Saturated Zone Layer

The saturated zone layer extends from a depth of six (6) to ten (10) meters. The soils change from brown silty clay to reddish-brown and grey weathered shale. The depth to bedrock ranges from nine (9) to ten (10) meters in depth.

5.3 Exposure Scenarios

Sigma identified the most realistic exposure scenarios applicable to future potential use receptors.

A number of physical and demographic properties pertinent to the site contribute plausible and



realistic conditions under which an individual might be exposed. The future use of the property as described in Section 3.3 was also considered.

We believe the most likely exposure scenarios for the site are:

- **Industrial Worker** - A hypothetical worker at the site who is present there for eight (8) hours per day, consumes water from an onsite well, does not consume food grown from the site, leaves the site after the work shift is complete, and does not work on weekends.
- **Suburban Resident** - A hypothetical individual who lives on the site in a condominium unit, is present for twenty-four (24) hours a day, consumes water from an onsite well, and does not consume food from the site.

5.4 Dose Modeling Results

The site-specific dose modeling used to generate the DCGLs for FMS is included as Appendix D. The document details the key parameters input parameters from RESRAD, justification for modifying key input parameters from default values, a copy of the dose modeling reports, and the sensitivity analysis. The following table is a comparison to the applicable activity concentration and its dose:

Table 5-1 DCGLs and Dose Limits

Scenario	DCGLs		Annual Dose Limit (millirem TEDE)
	¹⁴ C (pCi/g)	³ H (pCi/g)	
Industrial Worker	401	723	25
Suburban Resident	401	722	25

This table shows the source term in each of the scenarios considered is projected to produce a peak mean annual dose that would be just below the dose limits for unrestricted release of the site as specified in 10 CFR 20.1402 and 1403.



6.0 ALARA ANALYSIS

The average soil concentration from all data collected from FMS shows that the average concentration is well below the DCGLs proposed in this DP. The soil contamination levels are below the DCGL which are in affect at ALARA levels for members of the public. All personnel that will be working on the FMS will be required to participate in a Radiation Protection Program that encompasses the ALARA mindset. A tailored procedure dedicated to the ALARA principle will be utilized by all workers during the implementation of this DP.



7.0 RADIATION PROTECTION

All workers at the Fort Mims Site are required to have some level of training in Radiation protection and Health Physics. Eating, drinking and smoking are not allowed within the restricted area. Workers are required to wear safety glasses and gloves at all times. Workers hands and feet are monitored whenever they leave the work zone. All tools and equipment are surveyed for total and removable radioactivity before they leave the job site.



8.0 PLANNED DECOMMISSIONING ACTIVITIES

This chapter contains the description of Sigma's proposed approach for decommissioning the FMS.

A Final Status Survey Report (FSSR) will be assembled from the existing site characterization data to demonstrate compliance with the license termination rule. No further monitoring of the groundwater is planned since there were no upward trends from the quarterly sampling. There is currently no plan for removal of impacted soils from the FMS based on the concentrations of contaminants found in soils.



9.0 QUALITY ASSURANCE PROGRAM

FMS Quality Assurance (QA) Program that will be used to assure that samples obtained during decommissioning activities were performed in a manner consistent with the commitments in this DP and will meet regulatory requirements for license termination. The QA Program will operate in all stages of decommissioning through the final survey, validation of the data, and interpretation of the results. Included herein is a description of the following aspects of the QA Program: Organization; Quality Assurance Program; Document Control; Survey and Sampling Activities; Field Survey Data; Sample Chain of Custody; Lab Services; Control of Measuring and Test Equipment; Laboratory Data; Data Evaluation; Audits and Corrective Action.

9.1 Organization

The Decommissioning Project Manager will appoint a Quality Assurance Officer (QAO) who shall be responsible for verifying that activities affecting quality have been correctly performed will have sufficient authority, access to work areas, and organizational freedom to:

- Identify quality problems;
- Initiate, recommend or provide solutions to quality problems through designated channels;
- Verify implementation of solutions; and
- Ensure that further decommissioning activities are controlled until proper disposition of a nonconformance or deficiency has occurred.

The ultimate responsibility for implementing the elements of the QA Program rests with FMS, who will ensure the quality programs of principal contractors are acceptable under the quality provisions of this DP.

The technical and quality assurance procedures necessary for implementation of the QA Program will be consistent with regulatory, licensing, and the requirements noted in this Chapter of the DP. Specifically, Sigma FMS commits to the following:

- Performing monthly management reviews of the QA Program;



- Maintaining control over quality-affecting procedures of the principal contractors by requiring FMS approvals of such procedures prior to their implementation; and
- Ensuring NRC approval of any significant changes in the QA provisions of this DP

9.1.1 Decommissioning Project Manager

Overall control and authority for radiation protection at FMS will rest with the decommissioning Project Manager. The responsibility of the Project Manager will include, but is not limited to, the following:

- Establish the procedures to decommission the site and submit changes to the DP to the NRC. The Project Manager may not implement the changes until approved by the NRC in writing;
- Assure that the capability of radiation protection services are sufficient to meet the requirements of this DP and applicable state or federal regulations;
- Designate a QAO as a direct reporting officer with respect to the QA program.

9.1.2 Quality Assurance Officer

The QAO will be responsible for recommending the staffing types and levels and other resources necessary for full implementation of the QA Program. The QAO will have the responsibility and authority to suspend or terminate any work activities that do or may violate regulatory or FMS requirements for decommissioning. Specific work activities will be permitted to proceed to a safe condition after implementation of the stop-work order. Stop-work orders will be lifted after the initiating conditions have been remedied.

The QAO is specifically responsible for the following:

- Identifying quality problems;
- Initiating, recommending, or providing solutions through designated channels, and



- Verifying implementation of solutions.

The QAO is also responsible for working with Sigma, contractor, or subcontractor management in resolving differences of opinion between QA staff and other personnel regarding quality matters.

9.2 Quality Assurance Program Plan

The execution of decommissioning activities at the FMS will be performed under a Quality Assurance Program Plan (QAPP). The QAPP will be reviewed and approved by the QAO and FMS management prior to its implementation to ensure all programmatic elements are consistent with regulatory, licensing, and QA program requirements. The objective of the QAPP is to ensure confidence in the sampling, analysis, interpretation and use of radiological data generated during the decommissioning process.

The QAPP describes the functional activities and quality assurance/quality control (QA/QC) protocols necessary for collection of data with adequate quality. The QAPP will ensure collection of reliable data by controlling field and analytical activities associated with the decommissioning project. Stated within the QAPP are the quality assurance policies, quality control criteria, and reporting requirements that must be followed by all site personnel when carrying out their assigned responsibilities.

The approved QAPP will also address the following topics:

- Discussion of instruction to be provided to personnel responsible for performing activities affecting quality pertaining to the purpose, scope, and implementation of the quality-related manuals, instructions, and procedures;
- Description of training and qualifications of personnel verifying activities affecting quality in the principles, techniques, and requirements of the activity being performed;
- Formal training and qualification programs, documentation of which includes attendees, date of attendance, and objectives and content of program;



- Description of the self-assessment program for confirming that activities affecting quality comply with the QA program, including independence of the assessors from the activities they are assessing; and
- Description of the organization responsibilities for ensuring that activities affecting quality are prescribed in appropriate procedures and accomplished through implementation of these procedures.
- Description of how the licensee develops, issues, revises, maintains and retires QA documents.

9.3 Procedures

Supporting Quality Implementing Procedures (QIPs) will provide step-by-step details for complying with project QA requirements. The final radiological survey, including development of sampling plans, direct measurements, sample analysis, instrument calibration, daily functional checks of instruments, and sampling methods will be performed according to written procedures. These written procedures will be reviewed and approved by the Radiation Safety Officer (RSO) and the Project Manager.

9.4 Document Control

QA documents include a variety of radiation protection procedures. Sigma will retain QA documents at the FMS during decommissioning activities. At the conclusion of decommissioning, FMS will store QA documents in accordance with the terms of the DP.

Data subject to QA Program requirements will be recorded and documented in a data management system. Entries will include the location of the surveyor sampling point on the appropriate building grid. Data management personnel will also ensure that chain-of-custody and data management procedures are followed for decommissioning-related samples. The Decommissioning Contractor's procedures for proper handling, shipping and storage of samples will be used.

Both direct measurements and analytical results will be documented. The results for each survey measurement or sample and its grid block location will be listed in tabular form (i.e., result versus sample or survey location).



9.5 Surveys and Sampling Activities

Trained individuals following written procedures and the provisions of the DP will perform surveys and sampling using properly calibrated instruments. The custody of samples will be tracked from collection to analysis. The samplers will collect split samples when desired by the NRC to obtain samples that are duplicates of those to be analyzed. When this operation is performed, the procedure for obtaining duplicate samples will be followed.

Data will be recorded in an orderly and verifiable way and reviewed for accuracy and consistency. Every step of the decommissioning process, from training personnel to calculating and interpreting the data, will be documented in a way that lends itself to audit. Records of training to demonstrate qualification will also be maintained.

All QA documents prepared in support of the decommissioning effort (i.e., the QAPP, project-specific quality control manuals/policies, quality-affecting procedures, and technical reports) will be peer-reviewed by individuals not responsible for their preparation and approved by the Decommissioning Project Manager, the QAO, and the RSO prior to implementation. Review, update and re-approval of QA documents shall follow the same process as the creation of a new document. No revisions to QA documents, other than for error corrections, to address identified quality failures, or as mandated by changes in the scope or work or work approach, will be made.

9.6 Field Survey Data

The generation, handling, computations, evaluation and reporting of final radiological survey data will be as specified in the Decommissioning Contractor's procedures. Included in these procedures will be a system for data review and validation to ensure consistency, thoroughness and acceptability. Qualified health and safety, operations, and/or engineering personnel will review and evaluate survey data.

9.7 Sample Chain of Custody

One of the most important aspects of sample management is to ensure that the integrity of the sample is maintained; that is, that there is an accurate record of sample collection, transport, analysis, and disposal. This ensures that samples are neither lost nor tampered with and that the



sample analyzed in the laboratory is actually and verifiably the sample taken from a specific location in the field.

Sample custody will be assigned to one individual at a time. This will prevent confusion of responsibility. Custody is maintained when (1) the sample is under direct surveillance by the assigned individual, (2) the sample is maintained in a tamper-free container, or (3) the sample is within a controlled-access facility.

The individual responsible for sample collection will initiate a chain-of-custody record using a standard form provided by the decommissioning contractor or analytical laboratory. A copy of this form will accompany the samples throughout transportation and analyses; and any breach in custody or evidence of tampering will be documented.

9.8 Laboratory Services

For off-site sample analysis, a qualified laboratory approved by Sigma will perform radiological analytical laboratory services for the decommissioning project. The laboratory will be responsible for all bench-level QA/QC, data reduction, data reporting, and analytical performance monitoring. Laboratory accuracy will be evaluated by the analysis of blank and spiked samples. Sample handling protocols, analytical procedures, and reporting procedures employed by the analytical laboratory will be described in the laboratory's Quality Assurance Plan.

The off-site laboratory will be responsible for assuring that all appropriate laboratory personnel are thoroughly familiar with its corporate quality policy and good laboratory practices, that demonstrable chain of custody is maintained from the point of sample receipt to sample disposal, and that all appropriate laboratory personnel meet the requisite qualifications for their positions. The Laboratory Director, or his/her equivalent or representative, will review and approve all reports. The Laboratory Director will also be responsible for assuring laboratory personnel have appropriate training to perform assigned responsibilities, and for daily management of the laboratory and its staff.

The off-site laboratory will have a QA designee who will be responsible for assuring that the QA/QC requirements, the corporate quality policy, and its associated operating procedures, including the



chain of custody process, are strictly followed. The QA designee will be responsible for review of data, and alerting the QAO and the Project Manager of the need for corrective action (when necessary). The QA designee will also be responsible for preparing project-specific QA/QC plans, as necessary.

9.9 Control of Measuring and Test Equipment

A variety of radiation measurement equipment will be used during the performance of decommissioning activities and the Final Status Survey (FSS). These will include exposure rate instruments, dose rate instruments, dose/exposure integrating devices, contamination survey instruments, analytical instruments (i.e., smear counters), field-ready spectrometers and ancillary devices (e.g., data loggers, geolocation devices, etc.).

Procedures for calibration, maintenance, accountability, operation and quality control of radiation detection instruments implement the guidelines established in American National Standard Institute (ANSI) standard ANSI N323.A and ANSI N42.17A. Although maintenance procedures may vary depending on the specific instrument type, the information and use limitations provided by the vendor of the instrument type will be followed.

Instruments will be calibrated at least annually or more frequently if so recommended by the vendor. Each ratemeter will be calibrated with a specific detector, designated by the detector serial number.

A contractor will provide calibration services using radiation sources which are traceable to the National Institute of Standards and Technology (NIST). Instruments shall be calibrated according to the guidelines of ANSI-N323, "Radiation Protection Instrumentation Test and Calibration", ANSI/NCSL Z540, "Calibration Laboratories and Measuring and Test Equipment-General Requirements" and/or the ISO/IEC 17025:1999 "General Requirements for the Competence of Testing and Calibration Laboratories", with the Certificate of Calibration citing the applicable standard used, and certifying that radiation sources are traceable to NIST.

A copy of all calibration certificates will be provided as part of the FSSR.



Each instrument will be labeled with a unique identifier (e.g., serial number of detector and rate meter) to enable traceability to surveys and records. Prior to each use, or daily when kept in use, each instrument shall be checked for the following, as applicable: battery function, high voltage, response to a reference source, reset button function, audible response function, physical damage, current calibration sticker and response to background radiation. The results of the daily checks will be recorded on forms which will be maintained as part of the project records. Instruments failing any pre-operational check will be taken out of service, segregated from other instruments, tagged as "out of service", and repaired and calibrated prior to use.

9.10 Lab Data

Data reduction, QC review, and reporting will be the responsibility of the analytical laboratory. Data reduction includes all automated and manual processes for reducing or organizing raw data generated by the laboratory. The laboratory will provide a data package for each set of analyses. Once a data package is received from the laboratory, the analytical results and pertinent QA/QC data will be compiled using standardized data formats. The data packages will serve as basic reference sheets for data validation, as well as for project data use.

9.11 Data Evaluation

Prior to releasing data for use by project staff, selected data will undergo data evaluation based on intended end use of the data. Data points chosen for evaluation will be examined to determine compliance with QA requirements and other factors that determine the quality of the data. Data taken during a characterization survey will be subjected to quality verification before being included in the FSSR. Data taken during a prior survey, e.g., characterization survey, may be usable as FSS data provided the data are subjected to quality verification and satisfy data quality objectives.

If sample data is rejected or data omissions are identified during the data validation, the data will be evaluated to judge the impact of the discrepancy on the project. Other corrective action may include re-sampling and analyzing, evaluating and amending sampling and analytical procedures and accepting data acknowledging the level of uncertainty.



9.12 Audits and Corrective Action

Audits and surveillances will be conducted during the course of the decommissioning project. Observations will be investigated, and corrections will be made as necessary. The observations and the proposed corrective actions will be documented and reviewed by the Project Manager and the QAO. The corrective action will be documented and the concurrence by the Project Manager and the QAO will be documented in writing. The person or department responsible for implementing the corrective action will be assigned to do so and a schedule will be established to implement the action. After a finding requiring corrective action is closed out, a surveillance will be conducted within thirty (30) days to verify that the problem requiring such action has been alleviated. Significant conditions adverse to quality, the cause of the conditions, and the corrective action taken to preclude repetition will be documented and reported to the RSO and, if appropriate, to upper levels of Sigma management for review and assessment.



10.0 RADIOACTIVE WASTE MANAGEMENT

This decommissioning plan does not call for the removal of impacted soils from the Fort Mims Site. Previous soil sampling events have generated soil tailings and PPE such as gloves and lab coats that may contain lower levels radioactive materials. These materials were collected, packaged into DOT approved containers, and disposed of by Sigma to a vendor authorized to receive those wastes.



11.0 ENVIRONMENTAL MONITORING

Environmental monitoring was not required during the execution of the Decommissioning Plan. This is due to the specific activity of the radionuclides at the Fort Mims Site being well characterized and at very low levels. A large amount of site soils would need to be ejected into the air to approach the regulatory limit for effluent emissions. There were no open excavations or pits during the soil sampling at Fort Mims. Soil samples were gathered using a Geo-Probe or similar machine that did not disburse a significant amount of material into the air.



12.0 FINAL STATUS SURVEY DESIGN

Once all soil sampling data has been reviewed and dose calculations are complete, the FSSR will be assembled. In addition the FSS data will be validated as specified in the QA portion of this document, and submitted as part of the FSSR for the Fort Mims Site. The objective of the FSS will be to collect sufficient information to demonstrate, to a reasonable degree of scientific certainty, that the radiological parameters at the site do not exceed the established DCGLs, and that the license termination criterion for unrestricted release has been met.

Sigma-Aldrich Manufacturing LLC

US NRC License #24-16273-01



Decommissioning Plan

Maryland Heights, MO

Fort Mims Site

Appendix A

Groundwater Well Boring Logs

Sigma-Aldrich Manufacturing LLC

US NRC License #24-16273-01



Decommissioning Plan

Maryland Heights, MO

Fort Mims Site

Appendix B

Groundwater Elevation Maps

Sigma-Aldrich Manufacturing LLC

US NRC License #24-16273-01



Decommissioning Plan

Maryland Heights, MO

Fort Mims Site

Appendix C

Groundwater Monitoring Report

Sigma-Aldrich Manufacturing LLC

US NRC License #24-16273-01



Decommissioning Plan

Maryland Heights, MO

Fort Mims Site

Appendix D

Determination of Site-Specific Derived Concentration Guideline Levels

2014 ENVIRO LOG J024002.03 - FORT MIMS.GPJ 00 CLONE ME.GPJ 6/1/16

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

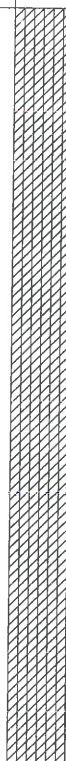
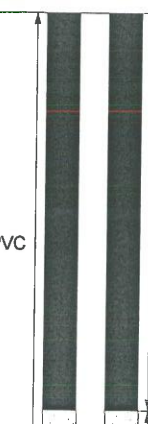
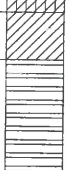
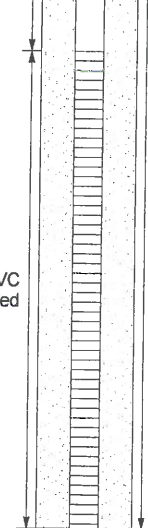
Surface Elevation: _____		Completion Date: <u>5/19/16</u>		GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM	
Datum: _____							Stickup Diameter: 2 inch	
DEPTH IN FEET	DESCRIPTION OF MATERIAL						Depth (ft) Elev. (ft)	
5	Brown, silty CLAY to SILT - CL-ML			2" sch 40 PVC	Bentonite	13.0 15.0		
10								
15								
20	Brown, silty CLAY - CL			2" sch 40 PVC 0.010 slotted	Filter Sand	35.0		
25	Reddish-brown and gray, weathered SHALE							
30								
35	Auger refusal at 35 feet.							

GROUNDWATER DATA		DRILLING DATA	
<u>X</u> FREE WATER NOT ENCOUNTERED DURING DRILLING		4 1/4" HOLLOW STEM FROM ____ TO ____ FEET	
		WASHBORING FROM ____ FEET	
		BLS DRILLER JPT LOGGER	
		CME 750X DRILL RIG	
		HAMMER TYPE <u>Auto</u>	
REMARKS: Speed drilled to 35 feet. No soil sampling performed.			


Drawn by: AGB	Checked by:	App'vd. by:
Date: 5/31/16	Date:	Date:
Fort Mims		
LOG OF BORING: GW01		
Project No. J024002.03		

2014 ENVIRO LOG J024002.03 - FORT MIMS.GPJ 00 CLONE ME.GPJ 6/1/16

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

Surface Elevation: _____ Datum: _____		Completion Date: <u>5/19/16</u>		GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM				
DEPTH IN FEET	DESCRIPTION OF MATERIAL	Stickup Diameter: 2 inch									
		Depth (ft)	Elev. (ft)								
5	Reddish brown, silty CLAY to SILT - CL-ML					DP1	2" sch 40 PVC		Bentonite	12.5 14.5	
10											DP2
15											DP3
20											DP4
25											DP5
25	Reddish brown, silty CLAY - CL						2" sch 40 PVC 0.010 slotted		Filter Sand	29.5	
25	Weathered SHALE										DP6
30	Auger refusal at 29.5 feet.										DP7
35											

GROUNDWATER DATA		DRILLING DATA	
<input checked="" type="checkbox"/> FREE WATER NOT ENCOUNTERED DURING DRILLING		4 1/4" HOLLOW STEM FROM ____ TO ____ FEET	
		WASHBORING FROM ____ FEET	
		BLS DRILLER JPT LOGGER	
		CME 750X DRILL RIG	
		HAMMER TYPE <u>Auto</u>	
REMARKS:			

Drawn by: AGB	Checked by:	App'vd. by:
Date: 5/31/16	Date:	Date:
 GEOTECHNOLOGY INC. FROM THE GROUND UP		
Fort Mims		
LOG OF BORING: GW02		
Project No. J024002.03		

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

2014 ENVIRO LOG J024002.03 - FORT MIMS.GPJ 00 CLONE ME.GPJ 6/1/16

Surface Elevation: _____ Datum: _____		Completion Date: <u>5/19/16</u>		GRAPHIC LOG DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM	
DEPTH IN FEET	DESCRIPTION OF MATERIAL		Stickup Diameter: 2 inch			Depth (ft) Elev. (ft)	
		FILL: brown, silty clay					
		Brown, silty CLAY to SILT - CL-ML					
5							
		Brown, silty CLAY - CL					
10							
		Reddish-brown and gray, weathered SHALE					
15							
		Auger refusal at 24.5 feet.					
20							
25							
30							
35							

GROUNDWATER DATA

X FREE WATER NOT
ENCOUNTERED DURING DRILLING

DRILLING DATA

4 1/4" HOLLOW STEM FROM ___ TO ___ FEET
 WASHBORING FROM ___ FEET
BLS DRILLER JPT LOGGER
CME 750X DRILL RIG
 HAMMER TYPE Auto

REMARKS:

Speed drilled to 35 feet. No soil sampling performed.

Drawn by: AGB	Checked by:	App'vd. by:
Date: 5/31/16	Date:	Date:



Fort Mims

LOG OF BORING: GW03

Project No. J024002.03

2014 ENVIRO LOG J024002.03 - FORT MIMS GPJ 00 CLONE ME GPJ 6/1/16

Surface Elevation: _____ Datum: _____		Completion Date: <u>5/18/16</u>		GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM		
DEPTH IN FEET	DESCRIPTION OF MATERIAL	Stickup Diameter: 2 inch							
		Depth (ft)	Elev. (ft)						
5	FILL: brown, silty clay					DP1	2" sch 40 PVC	Bentonite	3.5 4.5
10	Brown, silty CLAY to SILT - CL-ML					DP2			
15						DP3			
20	Brown, silty CLAY - CL					DP4	2" sch 40 PVC 0.010 slotted	Filter Sand	
25	Weathered SHALE					DP5			
30						DP6			
						DP7			
						DP8			
35	Auger refusal at 34 feet.								34.5

GROUNDWATER DATA

☒ FREE WATER NOT
ENCOUNTERED DURING DRILLING

DRILLING DATA


4 1/4" HOLLOW STEM FROM ____ TO ____ FEET
WASHBORING FROM ____ FEET
BLS DRILLER JPT LOGGER
CME 750X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: AGB
Date: 5/31/16

Checked by:
Date:

App'vd. by:
Date:

 **GEOTECHNOLOGY INC.**
FROM THE GROUND UP

Fort Mims

LOG OF BORING: GW04

Project No. J024002.03

LOG OF BORING 2002 NIE (NO GROUNDWATER) J024002.03 - FORT MIMS.GPJ 00 CLONE#16 THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

Surface Elevation: 506.82 Datum: NAVD88		Completion Date: 12/29/16 Northing: 1044809.753 Easting: 841359.709		GRAPHIC LOG DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM Flushmount Diameter: 8 inch	
DEPTH IN FEET	DESCRIPTION OF MATERIAL		Depth (ft) Elev. (ft)				
5	Brown, silty CLAY to CLAY - CL-CH		2" sch 40 PVC 2" sch 40 PVC 0.010 slotted	Concrete 1.0 505.8 Bentonite 8.0 498.8 10.0 496.8 Filter Sand 20.0 486.8			
10							
15							
20	Boring terminated at 20 feet.						
25							
30							
35							

DRILLING DATA

___ AUGER 4 1/4" HOLLOW STEM
 WASHBORING FROM ___ FEET
 ___ SJT DRILLER ___ JPT LOGGER
 ___ DRILL RIG
 HAMMER TYPE Auto

REMARKS: Top of casing elevation = 506.44 ft.

Drawn by: AGB
 Date: 8/29/17

Checked by: MSR
 Date: 8/29/17

App'vd. by: KJH
 Date: 8/29/17

GEOTECHNOLOGY
FROM THE GROUND UP

Fort Mims

LOG OF BORING: GW05

Project No. J024002.03

LOG OF BORING 2002 N/E (NO GROUNDWATER) J024002.03 - FORT MIMS.GPJ 00 CLONED FROM THE ORIGINAL
NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES
AND NOT THE BOUNDARIES BETWEEN SOIL TYPES. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

Surface Elevation: <u>508.95</u>		Completion Date: <u>12/28/16</u>		GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM	
Datum: <u>NAVD88</u>		Northing: <u>1044645.274</u> Easting: <u>841341.281</u>					Flushmount Diameter: 8 inch	
DEPTH IN FEET	DESCRIPTION OF MATERIAL	Depth (ft)	Elev. (ft)					
	Brown, silty CLAY to CLAY - CL-CH							
5								
10								
15								
20	Boring terminated at 19 feet.							
25								
30								
35								

2" sch 40 PVC

2" sch 40 PVC
0.010 slotted

Concrete

Bentonite

Filter Sand

1.0

7.0

9.0

19.0

508.0

502.0

500.0

490.0

DRILLING DATA


___ AUGER 4 1/4" HOLLOW STEM
WASHBORING FROM ___ FEET
___ SJT DRILLER ___ JPT LOGGER
___ DRILL RIG
HAMMER TYPE Auto

REMARKS: Top of casing elevation = 508.73 ft.

Drawn by: AGB
Date: 8/29/17

Checked by: MSR
Date: 8/29/17

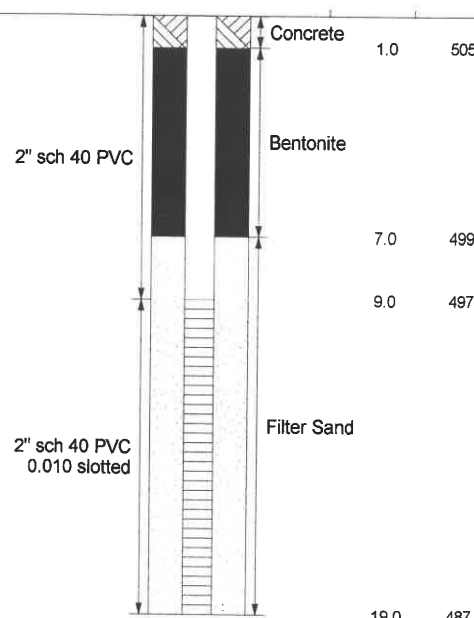
App'vd. by: KJH
Date: 8/29/17

 **GEOTECHNOLOGY INC.**
FROM THE GROUND UP

Fort Mims

LOG OF BORING: GW06

Project No. J024002.03

Surface Elevation: 506.88		Completion Date: 12/30/16		GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM	
Datum: NAVD88		Northing: 1044445.247 Easting: 841324.711					Flushmount Diameter: 8 inch	
DEPTH IN FEET	DESCRIPTION OF MATERIAL						Depth (ft) Elev. (ft)	
	Brown, silty CLAY to CLAY - CL-CH							
5					Concrete	1.0	505.9	
				Bentonite				
					7.0	499.9		
10					9.0	497.9		
				2" sch 40 PVC				
				2" sch 40 PVC 0.010 slotted				
15				Filter Sand				
	Boring terminated at 19 feet.				19.0	487.9		
20								
25								
30								
35								

Surface Elevation: 510.63 Datum: NAVD88		Completion Date: 12/29/16 Northing: 1044342.804 Easting: 841536.28		GRAPHIC LOG DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM Flushmount Diameter: 8 inch	
DEPTH IN FEET		DESCRIPTION OF MATERIAL				Depth (ft) Elev. (ft)	
5		Brown, silty CLAY to CLAY - CL-CH			1.0	509.6	
10					12.0	498.6	
15					14.0	496.6	
20							
25		Boring terminated at 24 feet.			24.0	486.6	
30							
35							

DRILLING DATA

AUGER 4 1/4" HOLLOW STEM
 WASHBORING FROM FEET
 SJT DRILLER JPT LOGGER
 DRILL RIG
 HAMMER TYPE Auto

Drawn by: AGB
 Date: 8/29/17

Checked by: MSR
 Date: 8/29/17

App'vd. by: KJH
 Date: 8/29/17

GEOTECHNOLOGY INC.
FROM THE GROUND UP

Fort Mims

LOG OF BORING: GW08

Project No. J024002.03

REMARKS: Top of casing elevation = 510.40 ft.

NOTES

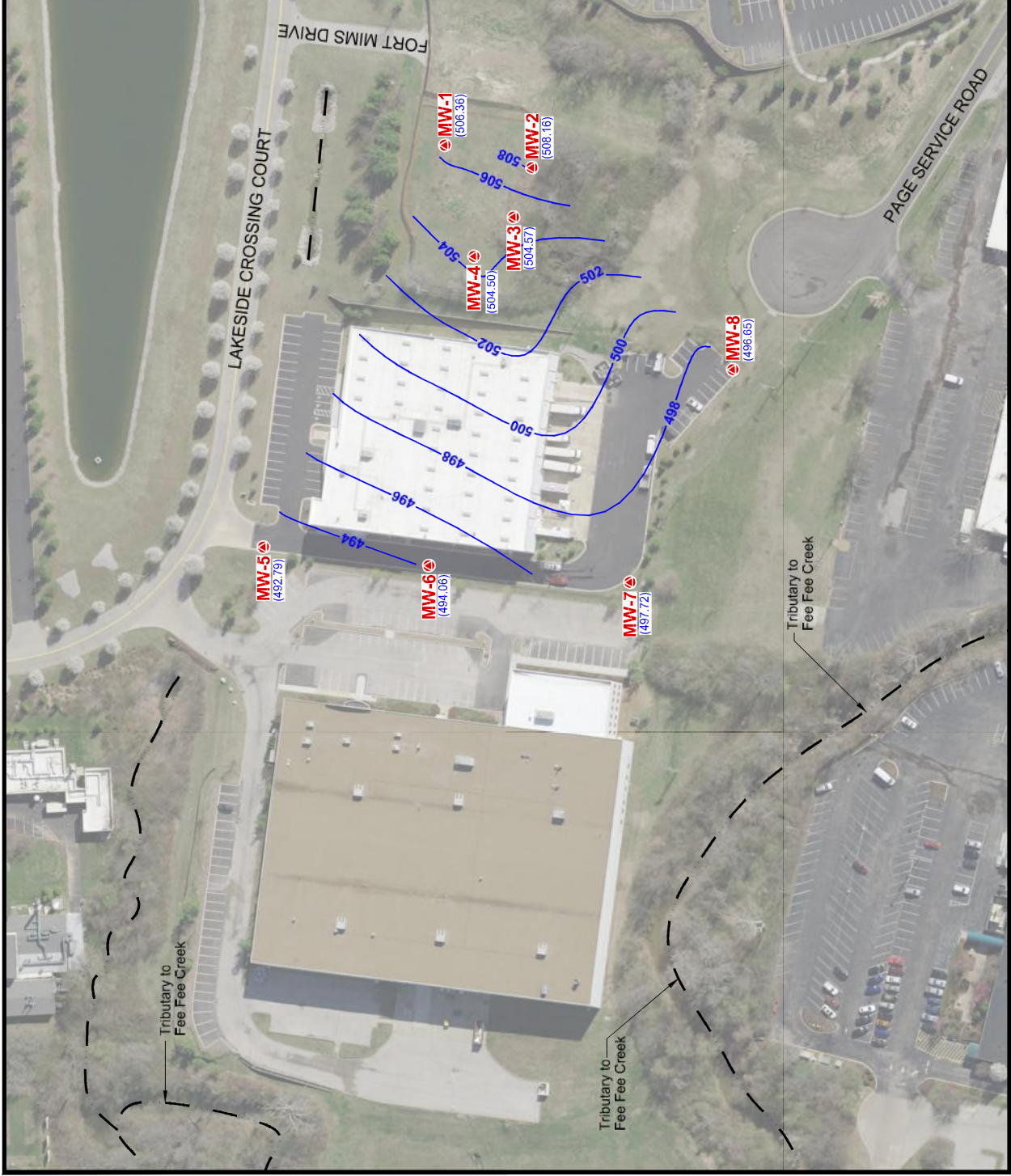
1. Plan adapted from "2015 Aerial Imagery for the St. Louis Region" supplied by East-West Gateway Council of Governments.
2. Groundwater elevations are for the uppermost saturated zone.

LEGEND

- Monitoring Well Location
(404.50)
- Groundwater Elevation at Well Location
(January 2017)
- Groundwater Elevation Contour



Drawn By: WAH	Ckd By: KJH	App'd By: KJH
Date: 1-25-17	Date: 3-23-17	Date: 3-24-17
Data Evaluation Fort Mims Drive Maryland Heights, Missouri		
GROUNDWATER CONTOUR MAP JANUARY 2017		
Project Number J02-4002.03	PLATE 2	




NOTES

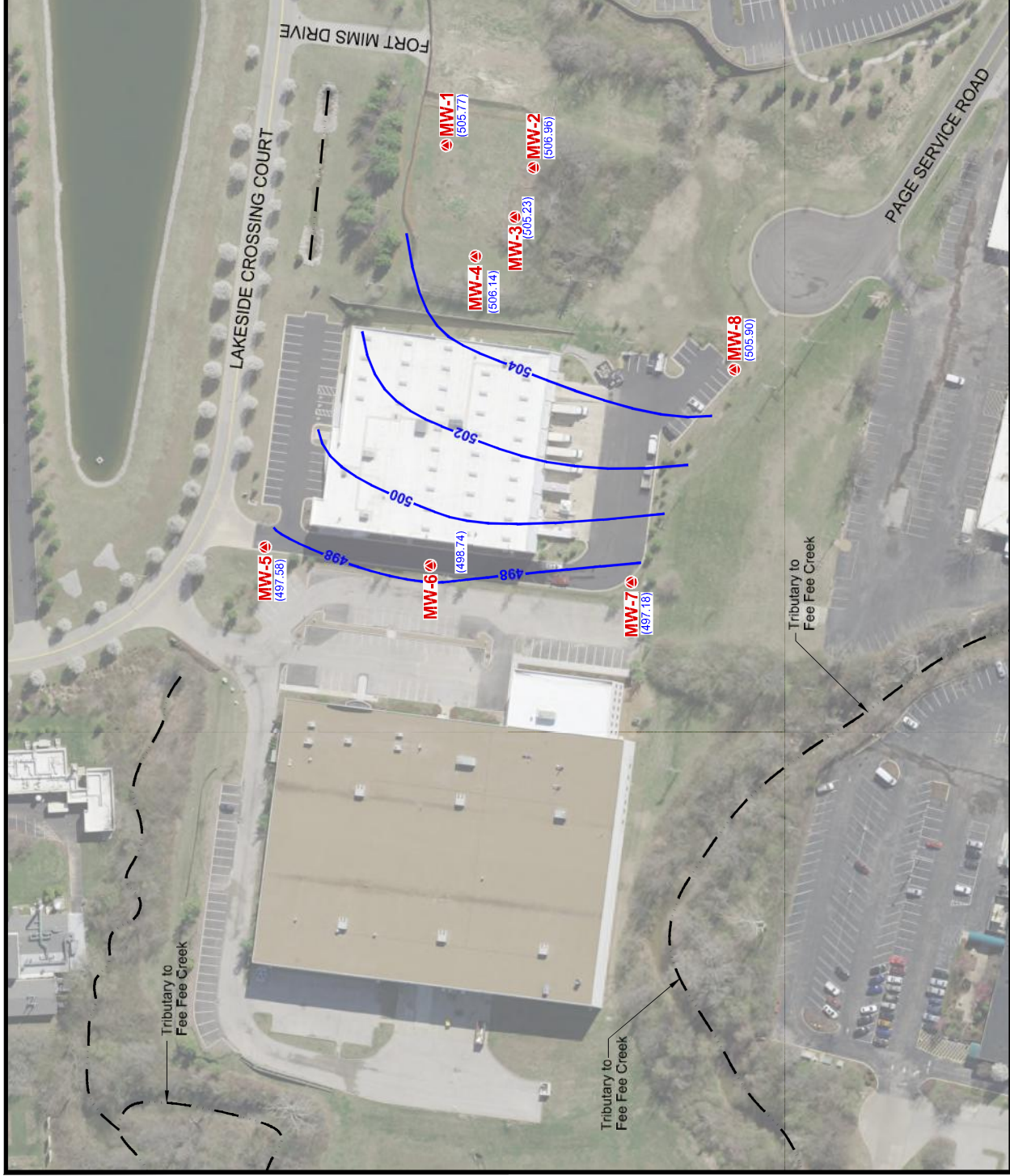
1. Plan adapted from "2015 Aerial Imagery for the St. Louis Region" supplied by East-West Gateway Council of Governments.
2. Groundwater elevations are for the uppermost saturated zone.

LEGEND

- Monitoring Well Location (505.98)
- Groundwater Elevation at Well Location (April 2017)
- Groundwater Elevation Contour



Drawn By: WAH	Ckd By: KJH	App'd By: KJH
Date: 4-17-17	Date: 7-25-17	Date: 7-25-17
 GEOTECHNOLOGY FROM THE GROUND UP		
Data Evaluation Fort Mims Drive Maryland Heights, Missouri		
GROUNDWATER CONTOUR MAP APRIL 2017		
Project Number J02-4002.03	PLATE 2	



NOTES

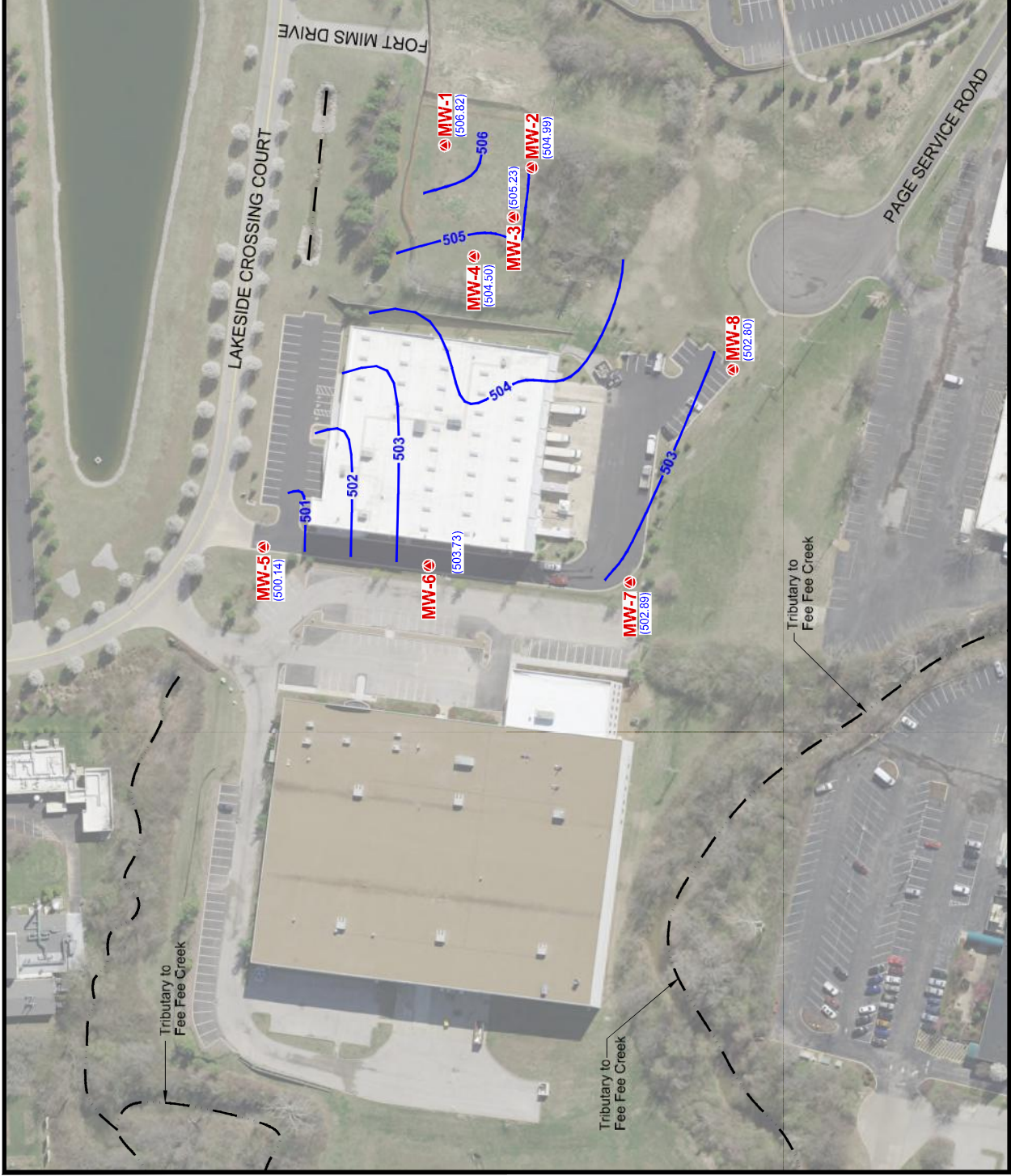
1. Plan adapted from "2015 Aerial Imagery for the St. Louis Region" supplied by East-West Gateway Council of Governments.
2. Groundwater elevations are for the uppermost saturated zone.

LEGEND

- Monitoring Well Location
(505.23)
(July 2017)
- Groundwater Elevation Contour






Drawn By: WAH	Ckd By: KJH	App'd By: KJH
Date: 7-25-17	Date: 7-25-17	Date: 7-25-17
Data Evaluation Fort Mims Drive Maryland Heights, Missouri		
GROUNDWATER CONTOUR MAP JULY 2017		
Project Number J02-4002.03	PLATE 2	




NOTES

1. Plan adapted from "2015 Aerial Imagery for the St. Louis Region" supplied by East-West Gateway Council of Governments.
2. Groundwater elevations are for the uppermost saturated zone.

LEGEND

-  Monitoring Well Location
-  Groundwater Elevation at Well Location (April 2018)
-  Groundwater Elevation Contour



Drawn By: WAH	Ckd By: KJH	App'd By: KJH
Date: 5-8-18	Date: 5-8-18	Date: 5-8-18
 GEOTECHNOLOGY FROM THE GROUND UP		
Data Evaluation Fort Mims Drive Maryland Heights, Missouri		
GROUNDWATER CONTOUR MAP APRIL 2018		
Project Number J02-4002.03	PLATE 2	



**Groundwater Sampling Results
Sigma Aldrich Fort Mims Site
Maryland Heights, Missouri**

**U.S. Nuclear Regulatory Commission
Radioactive Materials License No. 24-16273-01**

Sigma-Aldrich Company

**PO Box 14508
St. Louis, MO 63178**

Prepared by:



**DDES LLC
4 Arrow Drive,
Woburn, MA 01801**

May 2, 2018



EXECUTIVE SUMMARY

Decontamination Decommissioning and Environmental Services, LLC (DDES) was retained by Sigma-Aldrich to obtain groundwater samples from the Sigma Aldrich Fort Mims Site (FMS) at 11542 Fort Mims Drive in Maryland Heights, Missouri to determine if dissolved carbon (^{14}C) and tritium (^3H) were present in shallow groundwater. This work was performed in compliance with the approved *Groundwater Evaluation Plan* dated January 20th, 2016. This groundwater evaluation plan was designed to assess potential impacts to downgradient shallow groundwater from upper soils contamination at the FMS.

Three (3) monitoring wells were installed on the trailing edge of the defined soils contamination area in the prevailing direction of groundwater flow. One (GW01) was installed up gradient to serve as the background reference for the site. These locations were selected to support non-dispersion modeling using RESRAD 7.2 site-specific parameters.

The initial results of the onsite groundwater evaluation indicate shallow groundwater is present on the site and dissolved ^{14}C and ^3H are present in detectible quantities downgradient of the soils contamination. Based on these results an additional four (4) offsite monitoring wells were installed to establish groundwater elevations, direction of flow and determine the extent of groundwater contamination.

A total of six (6) separate quarters of onsite and four (4) quarters of offsite groundwater monitoring have been completed to date. The results indicate that levels of ^{14}C and ^3H in ground water are not increasing and are fairly stable. All results are below the United States Environmental Protection Agency's (USEPA) Primary Drinking Water Standards for radionuclides.



1. GROUNDWATER EVALUATION METHODOLOGY

Four monitoring wells were installed at the site in accordance with the Missouri Department of Natural Resources guidelines. Geotechnology Inc. provided permitting and installed the wells as shown in Attachment A. Based on previous site soil sampling two inch diameter monitoring wells were selected due to the permeability and low recharge rate of the site geology. Each well location was drilled to the point of refusal at bedrock and a large length of screen installed to capture groundwater.

Saturation in soil on the site occurs at depths generally ranging from 15-20 feet below ground surface. The depth to groundwater is less than ten feet below ground surface at off-site properties to the west of the site.

As expected site boring logs document surficial soils on top of bedrock are mostly silty clay (CL) and clayey silt (ML) ranging in depth from approximately 16 feet to 25 feet. This was followed by a layer of weathered shale ranging in thickness from 4 feet to 13 feet. None of the boreholes were found to have had free water during well installation. Auger refusal depth ranged from 24.5 feet (GW03) to 34 feet (GW04). The well installation boring logs for each location are provided in Appendix A.

2. DATA COLLECTION AND SAMPLING

Six rounds of onsite quarterly groundwater sampling have been performed in 2016 and 2017. The offsite wells were installed in early 2017 and have been sampled for four consecutive quarters as well. After installation, the groundwater wells were allowed to equilibrate for 24 hours before evaluating for the presence of water. Only groundwater monitoring location GW03 did not produce water for the first round of sampling. The well has had sufficient water for sampling since then. The other monitoring wells produced water in sufficient quantities of groundwater for low flow sampling methods to be used. These wells were purged using low flow peristaltic pump until the turbidity, pH and conductivity parameters stabilized. The groundwater samples were obtained after stabilization.

The depth to groundwater was measured in each well to produce groundwater contour maps and establish the prevailing groundwater pathway. The Groundwater Contour Elevation Maps are presented in Appendix B. The prevailing groundwater direction is west.

2.1. SAMPLE SHIPMENT AND ANALYSIS

All samples were packaged and controlled in accordance with the site QA Program Plan. The samples were controlled using chain-of custody procedures, custody seals, and the use of field logbooks during collection.

The groundwater samples were driven to Test America Laboratories in Earth City, Missouri. Dissolved ¹⁴C concentrations were determined by Liquid Scintillation Counting (LSC) in accordance with Test America Procedure EERF C-01-1. Dissolved ³H concentrations were

determined using EPA Method 906.0 analysis. All samples were filtered prior to analysis using 0.45 micron filter. Test America is accredited by the National Environmental Laboratory Accreditation Program (NELAP) and is licensed to receive and analyze samples containing radioactive material.

2.2. SAMPLING QUALITY ASSURANCE

Quality assurance samples were collected for statistical analysis. For precision, one (1) field duplicate was obtained for every ten (10) samples collected. A field duplicate is a duplicate sample collected from the same sample aliquot. No analytical or quality control issues were noted by the laboratory.

3. SAMPLING RESULTS

Table 3-1 and 3-2 identifies the well locations and analytical results to date for ¹⁴C and ³H respectively. The analytical results are included in Attachment A.

**Table 3-1
Fort Mims Quarterly ¹⁴C Groundwater Monitoring Results**

Monitoring Well Location	May 20 th , 2016	September 19 th , 2016	December 29 th , 2016	January 9 th , 2017	April 10 th , 2017	July 6 th , 2017	April 3 rd , 2018
	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
GW01	<5.20*	<6.20*	19.4	NS	56.8	17.1	21.4
GW02	101	51.4	118	NS	126	125	68.6
GW03	Dry	105	647	NS	632	505	514
GW04	63.5	32.8	86.9	NS	83.4	47.9	73.4
GW05	-	-	-	27.1	33.0	28.5	22.3
GW06	-	-	-	11.8	20.0	10.9	12.9
GW07	-	-	-	<11.8*	<10.4*	<5.4*	<1.80*
GW08	-	-	-	<11.6*	<10.5*	<5.3*	22.3

* – For those samples with results less than a detection limit, the detection limit is listed in the table. For purposes of calculating the dose, ½ the detection limit was used for sample results that were less than the detection limit for the analytical method.

**Table 3-2
Fort Mims Quarterly ³H Groundwater Monitoring Results**

Monitoring Well Location	May 20 th , 2016	September 19 th , 2016	December 29 th , 2016	January 9 th , 2017	April 10 th , 2017	July 6 th , 2017	April 3 rd , 2018
	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
GW01	1,530	6,980	5,780	NS	3,640	4,520	2,600
GW02	13,500	12,500	12,600	NS	8,100	11,000	6,440
GW03	Dry	1,150	1,230	NS	759	1,260	1,130
GW04	9,400	7,390	7,580	NS	8,220	8,770	9,500
GW05	-	-	-	7,980	7,260	6,960	5,160



Monitoring Well Location	May 20 th , 2016	September 19 th , 2016	December 29 th , 2016	January 9 th , 2017	April 10 th , 2017	July 6 th , 2017	April 3 rd , 2018
	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)	(pCi/L)
GW06	-	-	-	6,110	5,310	5,130	5,840
GW07	-	-	-	3,030	4,360	3,770	2,440
GW08	-	-	-	4,080	3,690	4,650	4,710

4. RESULTS AND CONCLUSIONS

The installation and sampling of eight environmental monitoring wells was performed to determine the nature and extent of shallow groundwater contamination at the FMS. The results indicate concentrations of both ^3H and ^{14}C are present in groundwater down gradient of the soils contamination area onsite and offsite concentrations were even lower. All sampling results were below the primary drinking water standards established by the USEPA for radionuclides.

4.1. Monitoring Results

The groundwater monitoring results for ^3H indicate levels were 1,530 pCi/L to 6,980 pCi/L in the background well location. This value is above the method reporting limit of 1,000 pCi/L as recommended by the USEPA. The sampling results indicate that dissolved ^3H was present in all locations down gradient of the defined soils contamination area. The ^3H results onsite ranged from 759 to 13,500 pCi/L with concentrations at each location being relatively stable across sampling events. These values indicate dissolved ^3H is present in groundwater at levels below the USEPA established Maximum Contaminant Level (MCL) of 4 millirem per year for beta particle and photon radioactivity from man-made radionuclides in drinking water. The average concentration of ^3H which is assumed to yield 4 millirem per year is 20,000 picocuries (pCi/L).

The groundwater monitoring results for ^{14}C indicate levels ranged from non-detect (<5.20 pCi/L) at the background location to 647 pCi/L for the onsite wells. The offsite sampling results ranged from non-detect (<1.80 pCi/L) to a high of 33 pCi/L. The sampling results indicate that dissolved ^{14}C was present in onsite locations down gradient of the defined soils contamination area. The offsite ^{14}C results indicate levels were below the detection limit in one location during the entire sampling period, below the detection limit 3 of the 4 times in one location, and present in the other two well locations. These values indicate dissolved ^{14}C is present in onsite groundwater at levels below the USEPA established a Maximum Contaminant Level (MCL) of 4 millirem per year for beta particle and photon radioactivity from man-made radionuclides in drinking water. The average concentration of ^{14}C which is assumed to yield 4 millirem per year is 2,000 picocuries (pCi/L). In addition, offsite monitoring results indicate concentrations decrease farther from the site.



4.2. Sum of the Fractions and Unity Rule

The USEPA does not set individual limits for each radionuclide, only for groups of them. ^{14}C and ^3H are both man made beta emitters and therefore are limited to 4 millirem per year for both radionuclides together. To demonstrate that the Fort Mims Site groundwater meets this requirement the Sum of the Fractions Unity Rule calculations have been completed. This is done in the following manner;

$$\frac{101 \text{ pCi/L } ^{14}\text{C}}{2000 \text{ pCi/L Limit } ^{14}\text{C}} + \frac{13500 \text{ pCi/L } ^3\text{H}}{20000 \text{ pCi/L Limit } ^3\text{H}} = 0.73$$

Table 4-1 and Table 4-2 presents the Unity Rule calculations for both onsite and offsite wells. This table selects the monitoring well with the highest calculated Unity Value for ^3H and ^{14}C for both the onsite and offsite wells respectively.

Table 4-1
Fort Mims Sum of the Fractions
Onsite Groundwater Monitoring Results

Onsite Wells						
Date	May 20 th , 2016	September 19 th , 2016	December 29 th , 2016	April 10 th , 2017	July 6 th , 2017	April 3 rd , 2018
^{14}C Max Value (pCi/L)	101	51	118	126	125	73
^3H Max Value (pCi/L)	13,500	12,500	12,600	8,100	11,000	9,500
Sum of Fractions	0.73	0.65	0.69	0.47	0.61	0.51

The offsite well's Unity concentrations were also calculated to ensure compliance with the USEPA MCL. The same conservative method used in Table 4-1 was applied in Table 4-2.

Table 4-2
Offsite Fort Mims Sum of the Fractions
Offsite Groundwater Monitoring Results

Offsite Wells				
Date	January 9 th , 2017*	April 10 th , 2017	July 6 th , 2017	April 3 rd , 2018
¹⁴ C Max Value (pCi/L)	27	33	29	13
³ H Max Value (pCi/L)	7,980	7,260	6,960	5,840
Sum of Fractions	0.41	0.38	0.36	0.30

The highest measured onsite concentration of both isotopes with respect to Unity Rule is GW02 on 5/20/2016, with a value of 0.73. The highest measured offsite concentration of both isotopes with respect to Unity Rule is GW05 on 1/9/2017 with a value of 0.41. The average concentration across all onsite wells and for all monitoring periods when Unity Rule is applied comes to 0.39. The average concentration across all offsite wells and for all monitoring periods when Unity Rule is applied comes to 0.26. Secondly, since all the results from Table 4-1 and 4-2 are less than one, the total dose from all radionuclides is less than the limit prescribed by the USEPA of 4 mrem/year.

4.3. Conclusion

The results of the groundwater evaluation results indicate that detectable quantities of dissolved ¹⁴C and ³H are present in shallow groundwater onsite and down gradient of the areas of defined soils contamination. However, all sampling results were below the primary drinking water standards established by the USEPA for radionuclides. Also, off site sampling results indicate concentrations decrease farther from the site. The sampling data obtained over several quarters indicate isotopic concentrations in groundwater are relatively stable and are not increasing over time. Based on this data we do not believe further groundwater investigation is warranted.



Attachment A

Monitoring Well Analytical Results

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-17472-1

Client Project/Site: MA-15-028

For:

Decontamination Decommissioning and Envi
345 North Avenue, 2nd Floor
Wakefield, Massachusetts 01880

Attn: Matt Norton

Elizabeth M. Hoerchler

Authorized for release by:

6/20/2016 1:38:58 PM

Elizabeth Hoerchler, Project Mgmt. Assistant
(314)298-8566

elizabeth.hoerchler@testamericainc.com

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www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Job ID: 160-17472-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Decontamination Decommissioning and Environmental Services

Project: MA-15-028

Report Number: 160-17472-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 05/20/2016; the samples arrived in good condition, properly preserved and on ice. The temperature of the coolers at receipt was 18.0° C.

TRITIUM

Samples GW01 (160-17472-1), GW02 (160-17472-2), GW02 QC (160-17472-3) and GW04 (160-17472-4) were analyzed for Tritium in accordance with EPA Method 906.0. The samples were prepared on 06/17/2016 and analyzed on 06/19/2016 and 06/20/2016.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CARBON-14 BY LSC

Samples GW01 (160-17472-1), GW02 (160-17472-2), GW02 QC (160-17472-3) and GW04 (160-17472-4) were analyzed for Carbon-14 by LSC in accordance with C_01_1. The samples were prepared on 06/16/2016 and analyzed on 06/19/2016.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Chain of Custody Record

Client Information Client Contact: Ryan Fahey Company: DDES, LLC Address: 345 North Avenue 2nd Floor City: Wakefield State, Zip: MA, 01880 Phone: [blank] Email: rfahey@ddesllc.com Project Name: MA-15-028 Site: <i>Fort Mims Facility</i>		Lab PM: Hoerchler, Elizabeth M E-Mail: elizabeth.hoerchler@testamerica.com Carrier Tracking No(s): 160-4107-2004.1 Page: Page 1 of 1 Job #: [blank]	
Due Date Requested: 5/27/16 TAT Requested (days): 5 PO #: [blank] Purchase Order not required WO #: [blank] Project #: 16004022 SSOW#: [blank]		Analysis Requested Total Number of Containers: [blank]	
Sample Identification Sample ID: GW01 Sample ID: GW02 Sample ID: GW02-QC Sample ID: GW04		Sample Date: 5-20-16 Sample Time: 0913 Sample Type: G=Grab Matrix: Water Preservation Code: [blank]	
Field Filtered Sample (Yes or No) [X] Perform MS/MSD (Yes or No) [X] Moisture - Local Method [X] 900.0, C, 0.1 [X] 900.0 - Tritium [X] C, 0.1 - Carbon-14 [X]		Special Instructions/Note: 2 Filter Sample in lab 2 Filter Sample in lab 2 Filter Sample in lab 2 Filter Sample in lab	
Possible Hazard Identification <input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown <input checked="" type="checkbox"/> Radiological Deliverable Requested: I, II, III, IV, Other (specify) [blank]		Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) <input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input checked="" type="checkbox"/> Archive For 1 Months	
Empty Kit Relinquished by: [Signature] Relinquished by: [Signature] Relinquished by: [Signature] Relinquished by: [Signature]		Method of Shipment: 160-17472 Chain of Custody Date/Time: 5/20/16 12:57 Date/Time: 5/20/16 13:00 Date/Time: [blank] Date/Time: [blank]	
Custody Seals Intact: Δ Yes Δ No		Cooler Temperature(s) °C and Other Remarks: [blank]	

Login Sample Receipt Checklist

Client: Decontamination Decommissioning and Envi

Job Number: 160-17472-1

Login Number: 17472

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Method	Method Description	Protocol	Laboratory
906.0	Tritium, Total (LSC)	EPA	TAL SL
C-01-1	Carbon-14 (EERF C-01-1)	EERF	TAL SL

Protocol References:

EERF = EERF

EPA = US Environmental Protection Agency

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-17472-1	GW01	Water	05/20/16 09:13	05/20/16 13:00
160-17472-2	GW02	Water	05/20/16 10:07	05/20/16 13:00
160-17472-3	GW02 QC	Water	05/20/16 10:07	05/20/16 13:00
160-17472-4	GW04	Water	05/20/16 11:36	05/20/16 13:00

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Client Sample ID: GW01
Date Collected: 05/20/16 09:13
Date Received: 05/20/16 13:00

Lab Sample ID: 160-17472-1
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	1530		325	352	500	344	pCi/L	06/17/16 14:07	06/19/16 22:33	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	3.71	U	6.23	6.24	20.0	10.4	pCi/L	06/16/16 21:15	06/19/16 19:43	1

Client Sample ID: GW02
Date Collected: 05/20/16 10:07
Date Received: 05/20/16 13:00

Lab Sample ID: 160-17472-2
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	13500		798	1430	500	335	pCi/L	06/17/16 14:07	06/19/16 23:18	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	101		9.51	14.5	20.0	10.3	pCi/L	06/16/16 21:15	06/19/16 20:49	1

Client Sample ID: GW02 QC
Date Collected: 05/20/16 10:07
Date Received: 05/20/16 13:00

Lab Sample ID: 160-17472-3
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	14600		852	1540	500	355	pCi/L	06/17/16 14:07	06/20/16 00:03	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	135		10.5	17.9	20.0	10.5	pCi/L	06/16/16 21:15	06/19/16 21:56	1

Client Sample ID: GW04
Date Collected: 05/20/16 11:36
Date Received: 05/20/16 13:00

Lab Sample ID: 160-17472-4
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	9400		681	1070	500	342	pCi/L	06/17/16 14:07	06/20/16 00:26	1

TestAmerica St. Louis

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2 σ +/-)	Total Uncert. (2 σ +/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	63.5		8.44	10.9	20.0	10.5	pCi/L	06/16/16 21:15	06/19/16 23:02	1

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Method: 906.0 - Tritium, Total (LSC)

Lab Sample ID: MB 160-256914/1-A

Matrix: Water

Analysis Batch: 257079

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 256914

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	12.16	U	143	143	500	258	pCi/L	06/17/16 14:07	06/19/16 21:47	1

Lab Sample ID: LCS 160-256914/2-A

Matrix: Water

Analysis Batch: 257079

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 256914

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	4090	3143		455	500	263	pCi/L	77	74 - 114

Lab Sample ID: 160-17472-2 MS

Matrix: Water

Analysis Batch: 257079

Client Sample ID: GW02

Prep Type: Dissolved

Prep Batch: 256914

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	13500		4090	17570		1800	500	343	pCi/L	100	67 - 130

Lab Sample ID: 160-17472-1 DU

Matrix: Water

Analysis Batch: 257079

Client Sample ID: GW01

Prep Type: Dissolved

Prep Batch: 256914

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tritium	1530		1482		343	500	337	pCi/L	0.07	1

Method: C-01-1 - Carbon-14 (EERF C-01-1)

Lab Sample ID: MB 160-256844/1-A

Matrix: Water

Analysis Batch: 257080

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 256844

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	12.97		6.72	6.86	20.0	10.6	pCi/L	06/16/16 21:15	06/19/16 17:30	1

Lab Sample ID: LCS 160-256844/2-A

Matrix: Water

Analysis Batch: 257080

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 256844

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	1130	1137		125	20.0	10.5	pCi/L	101	38 - 112

TestAmerica St. Louis

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-17472-1

Rad

Filtration Batch: 252611

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17472-1	GW01	Dissolved	Water	Filtration	
160-17472-1 DU	GW01	Dissolved	Water	Filtration	
160-17472-2	GW02	Dissolved	Water	Filtration	
160-17472-2 MS	GW02	Dissolved	Water	Filtration	
160-17472-3	GW02 QC	Dissolved	Water	Filtration	
160-17472-4	GW04	Dissolved	Water	Filtration	

Prep Batch: 256844

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17472-1	GW01	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-2	GW02	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-3	GW02 QC	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-4	GW04	Dissolved	Water	LSC_Dist_Susp	252611
LCS 160-256844/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
MB 160-256844/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	

Prep Batch: 256914

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-17472-1	GW01	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-1 DU	GW01	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-2	GW02	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-2 MS	GW02	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-3	GW02 QC	Dissolved	Water	LSC_Dist_Susp	252611
160-17472-4	GW04	Dissolved	Water	LSC_Dist_Susp	252611
LCS 160-256914/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
MB 160-256914/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-19085-1

Client Project/Site: MA-15-028

For:

Decontamination Decommissioning and Envi
345 North Avenue, 2nd Floor
Wakefield, Massachusetts 01880

Attn: Matt Norton

Elizabeth M. Hoerchler

Authorized for release by:
10/21/2016 12:23:35 PM

Elizabeth Hoerchler, Project Mgmt. Assistant
(314)298-8566
elizabeth.hoerchler@testamericainc.com

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Job ID: 160-19085-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Decontamination Decommissioning and Envi

Project: MA-15-028

Report Number: 160-19085-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 09/20/2016; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 20.0° C.

TRITIUM

Samples GW01 (160-19085-1), GW02 (160-19085-2), GW03 (160-19085-3) and GW04 (160-19085-4) were analyzed for Tritium in accordance with EPA Method 906.0. The samples were prepared on 10/17/2016 and analyzed on 10/18/2016.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CARBON-14 BY LSC

Samples GW01 (160-19085-1), GW02 (160-19085-2), GW03 (160-19085-3) and GW04 (160-19085-4) were analyzed for Carbon-14 by LSC in accordance with C_01_1. The samples were prepared on 10/08/2016 and analyzed on 10/20/2016.

The following sample in batch 160-273664 has a RER (replicate error ratio) result (2.31) and a RPD (relative percent difference) result

Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Job ID: 160-19085-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

(75%) outside of the acceptance criteria of 1 and 40%, respectively: 160-19085-A-2-I DU. Duplicate precision is demonstrated in this batch by sample 160-19456-C-2-B DU. The LCS (Laboratory Control Sample) has an acceptable spike recovery demonstrating acceptable sample preparation and instrument performance. Matrix interference is suspected. GW01 (160-19085-1), GW02 (160-19085-2), GW02 (160-19085-2[DU]), GW02 (160-19085-2[MS]), GW03 (160-19085-3), GW04 (160-19085-4), (LCS 160-273664/2-A), (MB 160-273664/1-A), (160-19456-C-2-A), (160-19456-C-2-B DU) and (160-19456-C-2-C MS)

Carbon-14 exceeded the RPD limit for the duplicate of sample 160-19456-2. Refer to the QC report for details.

[illegible]

Login Sample Receipt Checklist

Client: Decontamination Decommissioning and Envi

Job Number: 160-19085-1

Login Number: 19085

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.
F	Duplicate RPD exceeds the control limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Method	Method Description	Protocol	Laboratory
906.0	Tritium, Total (LSC)	EPA	TAL SL
C-01-1	Carbon-14 (EERF C-01-1)	EERF	TAL SL

Protocol References:

EERF = EERF

EPA = US Environmental Protection Agency

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-19085-1	GW01	Water	09/19/16 13:58	09/20/16 10:15
160-19085-2	GW02	Water	09/19/16 15:22	09/20/16 10:15
160-19085-3	GW03	Water	09/20/16 09:45	09/20/16 10:15
160-19085-4	GW04	Water	09/19/16 13:01	09/20/16 10:15

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Client Sample ID: GW01
Date Collected: 09/19/16 13:58
Date Received: 09/20/16 10:15

Lab Sample ID: 160-19085-1
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	6980		513	800	500	281	pCi/L	10/17/16 14:57	10/18/16 03:22	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-4.39	U	7.21	7.23	20.0	12.4	pCi/L	10/08/16 13:52	10/20/16 05:17	1

Client Sample ID: GW02
Date Collected: 09/19/16 15:22
Date Received: 09/20/16 10:15

Lab Sample ID: 160-19085-2
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	12500		673	1290	500	268	pCi/L	10/17/16 14:57	10/18/16 09:46	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	51.4		9.10	10.7	20.0	12.8	pCi/L	10/08/16 13:52	10/20/16 06:23	1

Client Sample ID: GW03
Date Collected: 09/20/16 09:45
Date Received: 09/20/16 10:15

Lab Sample ID: 160-19085-3
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	1150		255	274	500	285	pCi/L	10/17/16 14:57	10/18/16 04:45	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	105		10.4	15.3	20.0	12.7	pCi/L	10/08/16 13:52	10/20/16 09:42	1

Client Sample ID: GW04
Date Collected: 09/19/16 13:01
Date Received: 09/20/16 10:15

Lab Sample ID: 160-19085-4
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	7390		532	840	500	288	pCi/L	10/17/16 14:57	10/18/16 05:06	1

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Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2 σ +/-)	Total Uncert. (2 σ +/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	32.8		8.45	9.16	20.0	12.5	pCi/L	10/08/16 13:52	10/20/16 10:48	1

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Method: 906.0 - Tritium, Total (LSC)

Lab Sample ID: MB 160-274797/1-A
Matrix: Water
Analysis Batch: 274940

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 274797

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	59.01	U	170	170	500	298	pCi/L	10/17/16 14:57	10/18/16 02:40	1

Lab Sample ID: LCS 160-274797/2-A
Matrix: Water
Analysis Batch: 274940

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 274797

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec.	%Rec. Limits
Tritium	3010	2890		434	500	282	pCi/L	96	74 - 114

Lab Sample ID: 160-19085-2 MS
Matrix: Water
Analysis Batch: 274972

Client Sample ID: GW02
Prep Type: Dissolved
Prep Batch: 274797

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec.	%Rec. Limits
Tritium	12500		3010	15230		1540	500	273	pCi/L	91	67 - 130

Lab Sample ID: 160-19085-2 DU
Matrix: Water
Analysis Batch: 274972

Client Sample ID: GW02
Prep Type: Dissolved
Prep Batch: 274797

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tritium	12500		12070		1250	500	268	pCi/L	0.16	1

Method: C-01-1 - Carbon-14 (EERF C-01-1)

Lab Sample ID: MB 160-273664/1-A
Matrix: Water
Analysis Batch: 275411

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 273664

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-6.066	U	7.47	7.50	20.0	13.0	pCi/L	10/08/16 13:52	10/20/16 03:04	1

Lab Sample ID: LCS 160-273664/2-A
Matrix: Water
Analysis Batch: 275411

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 273664

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec.	%Rec. Limits
Carbon-14	1130	472.5		53.7	20.0	12.4	pCi/L	42	38 - 112

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QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) (Continued)

Lab Sample ID: 160-19085-2 MS

Matrix: Water

Analysis Batch: 275411

Client Sample ID: GW02

Prep Type: Dissolved

Prep Batch: 273664

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	51.4		1130	992.0		110	20.0	13.7	pCi/L	83	37 - 121

Lab Sample ID: 160-19085-2 DU

Matrix: Water

Analysis Batch: 275411

Client Sample ID: GW02

Prep Type: Dissolved

Prep Batch: 273664

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Carbon-14	51.4		113.7	F	16.3	20.0	13.0	pCi/L	2.31	1

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-19085-1

Rad

Filtration Batch: 271436

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-19085-1	GW01	Dissolved	Water	Filtration	
160-19085-1	GW01	Dissolved	Water	Filtration	
160-19085-2	GW02	Dissolved	Water	Filtration	
160-19085-2	GW02	Dissolved	Water	Filtration	
160-19085-3	GW03	Dissolved	Water	Filtration	
160-19085-4	GW04	Dissolved	Water	Filtration	
160-19085-4	GW04	Dissolved	Water	Filtration	
160-19085-2 MS	GW02	Dissolved	Water	Filtration	
160-19085-2 DU	GW02	Dissolved	Water	Filtration	

Prep Batch: 273664

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-19085-1	GW01	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-2	GW02	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-3	GW03	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-4	GW04	Dissolved	Water	LSC_Dist_Susp	271436
MB 160-273664/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-273664/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-19085-2 MS	GW02	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-2 DU	GW02	Dissolved	Water	LSC_Dist_Susp	271436

Prep Batch: 274797

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-19085-1	GW01	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-2	GW02	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-3	GW03	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-4	GW04	Dissolved	Water	LSC_Dist_Susp	271436
MB 160-274797/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-274797/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-19085-2 MS	GW02	Dissolved	Water	LSC_Dist_Susp	271436
160-19085-2 DU	GW02	Dissolved	Water	LSC_Dist_Susp	271436

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-20559-1

Client Project/Site: MA-15-028

For:

Decontamination Decommissioning and Envi
345 North Avenue, 2nd Floor
Wakefield, Massachusetts 01880

Attn: Matt Norton

Elizabeth M. Hoerchler

Authorized for release by:

1/27/2017 5:14:31 PM

Elizabeth Hoerchler, Project Mgmt. Assistant
(314)298-8566

elizabeth.hoerchler@testamericainc.com

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Job ID: 160-20559-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Decontamination Decommissioning and Envi

Project: MA-15-028

Report Number: 160-20559-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 12/30/2016; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 17.0° C.

TRITIUM

Samples GW01 (160-20559-1), GW02 (160-20559-2), GW03 (160-20559-3) and GW04 (160-20559-4) were analyzed for Tritium in accordance with EPA Method 906.0. The samples were prepared on 01/25/2017 and analyzed on 01/26/2017.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CARBON-14 BY LSC

Samples GW01 (160-20559-1), GW02 (160-20559-2), GW03 (160-20559-3) and GW04 (160-20559-4) were analyzed for Carbon-14 by LSC in accordance with C_01_1. The samples were prepared on 01/23/2017 and analyzed on 01/26/2017.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Login Sample Receipt Checklist

Client: Decontamination Decommissioning and Envi

Job Number: 160-20559-1

Login Number: 20559

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Method	Method Description	Protocol	Laboratory
906.0	Tritium, Total (LSC)	EPA	TAL SL
C-01-1	Carbon-14 (EERF C-01-1)	EERF	TAL SL

Protocol References:

EERF = EERF

EPA = US Environmental Protection Agency

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-20559-1	GW01	Water	12/29/16 12:39	12/30/16 09:20
160-20559-2	GW02	Water	12/29/16 11:41	12/30/16 09:20
160-20559-3	GW03	Water	12/29/16 10:02	12/30/16 09:20
160-20559-4	GW04	Water	12/29/16 08:54	12/30/16 09:20

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Client Sample ID: GW01
Date Collected: 12/29/16 12:39
Date Received: 12/30/16 09:20

Lab Sample ID: 160-20559-1
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	5780		559	756	500	434	pCi/L	01/25/17 14:17	01/26/17 03:51	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	19.4		6.73	7.05	20.0	10.2	pCi/L	01/23/17 11:57	01/26/17 13:42	1

Client Sample ID: GW02
Date Collected: 12/29/16 11:41
Date Received: 12/30/16 09:20

Lab Sample ID: 160-20559-2
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	12600		783	1360	500	434	pCi/L	01/25/17 14:17	01/26/17 04:14	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	118		9.72	16.1	20.0	10.2	pCi/L	01/23/17 11:57	01/26/17 14:49	1

Client Sample ID: GW03
Date Collected: 12/29/16 10:02
Date Received: 12/30/16 09:20

Lab Sample ID: 160-20559-3
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	1230		325	343	500	415	pCi/L	01/25/17 14:17	01/26/17 04:37	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	647		18.9	72.3	20.0	10.1	pCi/L	01/23/17 11:57	01/26/17 15:55	1

Client Sample ID: GW04
Date Collected: 12/29/16 08:54
Date Received: 12/30/16 09:20

Lab Sample ID: 160-20559-4
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	7580		612	905	500	416	pCi/L	01/25/17 14:17	01/26/17 05:00	1

TestAmerica St. Louis

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2 σ +/-)	Total Uncert. (2 σ +/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	86.9		8.88	12.9	20.0	10.2	pCi/L	01/23/17 11:57	01/26/17 17:01	1

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Method: 906.0 - Tritium, Total (LSC)

Lab Sample ID: MB 160-289175/1-A
Matrix: Water
Analysis Batch: 289243

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 289175

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	330.3	U	262	264	500	418	pCi/L	01/25/17 14:17	01/26/17 03:06	1

Lab Sample ID: LCS 160-289175/2-A
Matrix: Water
Analysis Batch: 289243

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 289175

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	3950	3700		563	500	418	pCi/L	94	74 - 114

Lab Sample ID: 160-20559-4 MS
Matrix: Water
Analysis Batch: 289243

Client Sample ID: GW04
Prep Type: Dissolved
Prep Batch: 289175

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	7580		3950	11600		1260	500	415	pCi/L	102	67 - 130

Lab Sample ID: 160-20559-4 DU
Matrix: Water
Analysis Batch: 289243

Client Sample ID: GW04
Prep Type: Dissolved
Prep Batch: 289175

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tritium	7580		7880		934	500	422	pCi/L	0.16	1

Method: C-01-1 - Carbon-14 (EERF C-01-1)

Lab Sample ID: MB 160-288738/1-A
Matrix: Water
Analysis Batch: 289509

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 288738

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	3.844	U	6.15	6.17	20.0	10.2	pCi/L	01/23/17 11:57	01/26/17 11:30	1

Lab Sample ID: LCS 160-288738/2-A
Matrix: Water
Analysis Batch: 289509

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 288738

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	1130	1039		115	20.0	10.3	pCi/L	92	38 - 112

TestAmerica St. Louis

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) (Continued)

Lab Sample ID: 160-20559-4 MS

Matrix: Water

Analysis Batch: 289509

Client Sample ID: GW04

Prep Type: Dissolved

Prep Batch: 288738

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	86.9		1120	1132		125	20.0	10.1	pCi/L	93	37 - 121

Lab Sample ID: 160-20559-4 DU

Matrix: Water

Analysis Batch: 289509

Client Sample ID: GW04

Prep Type: Dissolved

Prep Batch: 288738

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Carbon-14	86.9		78.13		12.1	20.0	10.2	pCi/L	0.35	1

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20559-1

Rad

Filtration Batch: 285977

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-20559-1	GW01	Dissolved	Water	Filtration	
160-20559-2	GW02	Dissolved	Water	Filtration	
160-20559-3	GW03	Dissolved	Water	Filtration	
160-20559-4	GW04	Dissolved	Water	Filtration	
160-20559-4 MS	GW04	Dissolved	Water	Filtration	
160-20559-4 DU	GW04	Dissolved	Water	Filtration	

Prep Batch: 288738

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-20559-1	GW01	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-2	GW02	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-3	GW03	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-4	GW04	Dissolved	Water	LSC_Dist_Susp	285977
MB 160-288738/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-288738/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-20559-4 MS	GW04	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-4 DU	GW04	Dissolved	Water	LSC_Dist_Susp	285977

Prep Batch: 289175

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-20559-1	GW01	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-2	GW02	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-3	GW03	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-4	GW04	Dissolved	Water	LSC_Dist_Susp	285977
MB 160-289175/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-289175/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-20559-4 MS	GW04	Dissolved	Water	LSC_Dist_Susp	285977
160-20559-4 DU	GW04	Dissolved	Water	LSC_Dist_Susp	285977

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-20644-1

Client Project/Site: MA-15-028

For:

Decontamination Decommissioning and Envi
345 North Avenue, 2nd Floor
Wakefield, Massachusetts 01880

Attn: Matt Norton

Elizabeth M. Hoerchler

Authorized for release by:

2/6/2017 1:52:48 PM

Elizabeth Hoerchler, Project Mgmt. Assistant
(314)298-8566

elizabeth.hoerchler@testamericainc.com

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Job ID: 160-20644-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Decontamination Decommissioning and Envi

Project: MA-15-028

Report Number: 160-20644-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 01/09/2017; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 21.0° C.

TRITIUM

Samples DUPLICATE (160-20644-1), MW-05 (160-20644-2), MW-06 (160-20644-3), MW-07 (160-20644-4) and MW-08 (160-20644-5) were analyzed for Tritium in accordance with EPA Method 906.0. The samples were prepared on 02/02/2017 and analyzed on 02/03/2017.

The sample duplicate associate with following samples in batch 160-290822 has an RER (replicate error ratio) result outside of the acceptance criteria of 1 (1.30). Duplicate precision is demonstrated by acceptable relative percent difference (RPD), within the limit of 40% (32%). The data have been qualified and reported. DUPLICATE (160-20644-1), MW-05 (160-20644-2), MW-06 (160-20644-3), MW-07 (160-20644-4), MW-08 (160-20644-5), (LCS 160-290822/2-A), (MB 160-290822/1-A), (160-20644-A-1-D DU) and (160-20644-A-2-D MS)

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Job ID: 160-20644-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

CARBON-14 BY LSC

Samples DUPLICATE (160-20644-1), MW-05 (160-20644-2), MW-06 (160-20644-3), MW-07 (160-20644-4) and MW-08 (160-20644-5) were analyzed for Carbon-14 by LSC in accordance with C_01_1. The samples were prepared on 02/01/2017 and analyzed on 02/03/2017.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

THE LEADER IN ENVIRONMENTAL TESTING

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:[illegible]

Login Sample Receipt Checklist

Client: Decontamination Decommissioning and Envi

Job Number: 160-20644-1

Login Number: 20644

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Method	Method Description	Protocol	Laboratory
906.0	Tritium, Total (LSC)	EPA	TAL SL
C-01-1	Carbon-14 (EERF C-01-1)	EERF	TAL SL

Protocol References:

EERF = EERF

EPA = US Environmental Protection Agency

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-20644-1	DUPLICATE	Water	01/09/17 00:00	01/09/17 15:00
160-20644-2	MW-05	Water	01/09/17 10:36	01/09/17 15:00
160-20644-3	MW-06	Water	01/09/17 11:27	01/09/17 15:00
160-20644-4	MW-07	Water	01/09/17 12:30	01/09/17 15:00
160-20644-5	MW-08	Water	01/09/17 13:55	01/09/17 15:00

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Client Sample ID: DUPLICATE

Date Collected: 01/09/17 00:00

Date Received: 01/09/17 15:00

Lab Sample ID: 160-20644-1

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	6590		603	837	500	422	pCi/L	02/02/17 13:14	02/03/17 19:03	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	20.6		7.54	7.86	20.0	11.7	pCi/L	02/01/17 16:15	02/03/17 18:36	1

Client Sample ID: MW-05

Date Collected: 01/09/17 10:36

Date Received: 01/09/17 15:00

Lab Sample ID: 160-20644-2

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	7980		681	978	500	458	pCi/L	02/02/17 13:14	02/03/17 19:45	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	27.1		7.72	8.25	20.0	11.7	pCi/L	02/01/17 16:15	02/03/17 19:42	1

Client Sample ID: MW-06

Date Collected: 01/09/17 11:27

Date Received: 01/09/17 15:00

Lab Sample ID: 160-20644-3

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	6110		589	797	500	431	pCi/L	02/02/17 13:14	02/03/17 20:26	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	11.8		7.28	7.39	20.0	11.8	pCi/L	02/01/17 16:15	02/03/17 20:48	1

Client Sample ID: MW-07

Date Collected: 01/09/17 12:30

Date Received: 01/09/17 15:00

Lab Sample ID: 160-20644-4

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	3030		461	533	500	450	pCi/L	02/02/17 13:14	02/03/17 20:47	1

TestAmerica St. Louis

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-0.238	U	6.81	6.81	20.0	11.8	pCi/L	02/01/17 16:15	02/03/17 21:55	1

Client Sample ID: MW-08

Date Collected: 01/09/17 13:55

Date Received: 01/09/17 15:00

Lab Sample ID: 160-20644-5

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	4080		513	627	500	450	pCi/L	02/02/17 13:14	02/03/17 21:08	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-2.65	U	6.67	6.68	20.0	11.6	pCi/L	02/01/17 16:15	02/03/17 23:01	1

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Method: 906.0 - Tritium, Total (LSC)

Lab Sample ID: MB 160-290822/1-A
Matrix: Water
Analysis Batch: 291020

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 290822

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	-73.87	U	242	242	500	452	pCi/L	02/02/17 13:14	02/03/17 18:21	1

Lab Sample ID: LCS 160-290822/2-A
Matrix: Water
Analysis Batch: 291020

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 290822

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	3920	3916		596	500	421	pCi/L	100	74 - 114

Lab Sample ID: 160-20644-2 MS
Matrix: Water
Analysis Batch: 291020

Client Sample ID: MW-05
Prep Type: Dissolved
Prep Batch: 290822

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	7980		3950	11940		1330	500	450	pCi/L	100	67 - 130

Lab Sample ID: 160-20644-1 DU
Matrix: Water
Analysis Batch: 291020

Client Sample ID: DUPLICATE
Prep Type: Dissolved
Prep Batch: 290822

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tritium	6590		9117		1100	500	493	pCi/L	1.30	1

Method: C-01-1 - Carbon-14 (EERF C-01-1)

Lab Sample ID: MB 160-290623/1-A
Matrix: Water
Analysis Batch: 291024

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 290623

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-7.387	U	6.56	6.61	20.0	11.8	pCi/L	02/01/17 16:15	02/03/17 16:23	1

Lab Sample ID: LCS 160-290623/2-A
Matrix: Water
Analysis Batch: 291024

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 290623

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	1130	1047		116	20.0	11.7	pCi/L	93	38 - 112

TestAmerica St. Louis

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) (Continued)

Lab Sample ID: 160-20644-5 MS

Matrix: Water

Analysis Batch: 291024

Client Sample ID: MW-08

Prep Type: Dissolved

Prep Batch: 290623

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	-2.65	U	1120	955.3		106	20.0	11.7	pCi/L	85	37 - 121

Lab Sample ID: 160-20644-5 DU

Matrix: Water

Analysis Batch: 291024

Client Sample ID: MW-08

Prep Type: Dissolved

Prep Batch: 290623

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Carbon-14	-2.65	U	-6.219	U	6.74	20.0	12.0	pCi/L	0.27	1

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-20644-1

Rad

Filtration Batch: 287349

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-20644-1	DUPLICATE	Dissolved	Water	Filtration	
160-20644-2	MW-05	Dissolved	Water	Filtration	
160-20644-3	MW-06	Dissolved	Water	Filtration	
160-20644-4	MW-07	Dissolved	Water	Filtration	
160-20644-5	MW-08	Dissolved	Water	Filtration	
160-20644-2 MS	MW-05	Dissolved	Water	Filtration	
160-20644-5 MS	MW-08	Dissolved	Water	Filtration	
160-20644-1 DU	DUPLICATE	Dissolved	Water	Filtration	
160-20644-5 DU	MW-08	Dissolved	Water	Filtration	

Prep Batch: 290623

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-20644-1	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-2	MW-05	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-3	MW-06	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-4	MW-07	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-5	MW-08	Dissolved	Water	LSC_Dist_Susp	287349
MB 160-290623/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-290623/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-20644-5 MS	MW-08	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-5 DU	MW-08	Dissolved	Water	LSC_Dist_Susp	287349

Prep Batch: 290822

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-20644-1	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-2	MW-05	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-3	MW-06	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-4	MW-07	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-5	MW-08	Dissolved	Water	LSC_Dist_Susp	287349
MB 160-290822/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-290822/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-20644-2 MS	MW-05	Dissolved	Water	LSC_Dist_Susp	287349
160-20644-1 DU	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	287349

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-21811-1

Client Project/Site: MA-15-028

For:

Decontamination Decommissioning and Envi
345 North Avenue, 2nd Floor
Wakefield, Massachusetts 01880

Attn: Matt Norton

Elizabeth M. Hoerchler

Authorized for release by:
4/28/2017 10:13:25 AM

Elizabeth Hoerchler, Project Mgmt. Assistant
(314)298-8566
elizabeth.hoerchler@testamericainc.com

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Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Job ID: 160-21811-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: DDES

Project: MA-15-028

Report Number: 160-21811-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 04/11/2017; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 21.0° C.

TRITIUM

Samples GW-01 (160-21811-1), GW-02 (160-21811-2), GW-03 (160-21811-3), GW-04 (160-21811-4), GW-05 (160-21811-5), GW-06 (160-21811-6), GW-07 (160-21811-7), GW-08 (160-21811-8) and DUPLICATE (160-21811-9) were analyzed for Tritium in accordance with EPA Method 906.0. The samples were leached on 04/26/2017, and prepared and analyzed on 04/26/2017.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CARBON-14 BY LSC

Samples GW-01 (160-21811-1), GW-02 (160-21811-2), GW-03 (160-21811-3), GW-04 (160-21811-4), GW-05 (160-21811-5), GW-06 (160-21811-6), GW-07 (160-21811-7), GW-08 (160-21811-8) and DUPLICATE (160-21811-9) were analyzed for Carbon-14 by LSC in accordance with C_01_1. The samples were prepared on 04/21/2017 and analyzed on 04/21/2017 and 04/22/2017.

Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Job ID: 160-21811-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

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Login Sample Receipt Checklist

Client: Decontamination Decommissioning and Envi

Job Number: 160-21811-1

Login Number: 21811

List Number: 1

Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Method	Method Description	Protocol	Laboratory
906.0	Tritium, Total (LSC)	EPA	TAL SL
C-01-1	Carbon-14 (EERF C-01-1)	EERF	TAL SL

Protocol References:

EERF = EERF

EPA = US Environmental Protection Agency

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-21811-1	GW-01	Water	04/10/17 16:30	04/11/17 13:00
160-21811-2	GW-02	Water	04/11/17 08:33	04/11/17 13:00
160-21811-3	GW-03	Water	04/10/17 13:10	04/11/17 13:00
160-21811-4	GW-04	Water	04/10/17 10:42	04/11/17 13:00
160-21811-5	GW-05	Water	04/11/17 09:31	04/11/17 13:00
160-21811-6	GW-06	Water	04/11/17 10:19	04/11/17 13:00
160-21811-7	GW-07	Water	04/11/17 10:44	04/11/17 13:00
160-21811-8	GW-08	Water	04/11/17 11:30	04/11/17 13:00
160-21811-9	DUPLICATE	Water	04/11/17 00:00	04/11/17 13:00

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Client Sample ID: GW-01

Date Collected: 04/10/17 16:30

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-1

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	3640		430	536	500	336	pCi/L	04/26/17 13:07	04/26/17 18:00	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	56.8		8.09	10.2	20.0	10.4	pCi/L	04/21/17 07:51	04/21/17 19:16	1

Client Sample ID: GW-02

Date Collected: 04/11/17 08:33

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-2

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	8100		599	931	500	329	pCi/L	04/26/17 13:07	04/26/17 18:45	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	126		9.86	16.8	20.0	10.2	pCi/L	04/21/17 07:51	04/21/17 20:22	1

Client Sample ID: GW-03

Date Collected: 04/10/17 13:10

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-3

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	759		259	268	500	340	pCi/L	04/26/17 13:07	04/26/17 19:30	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	632		18.8	70.8	20.0	10.6	pCi/L	04/21/17 07:51	04/21/17 21:29	1

Client Sample ID: GW-04

Date Collected: 04/10/17 10:42

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-4

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	8220		612	947	500	336	pCi/L	04/26/17 13:07	04/26/17 19:53	1

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Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	83.4		8.91	12.7	20.0	10.4	pCi/L	04/21/17 07:51	04/21/17 22:35	1

Client Sample ID: GW-05

Date Collected: 04/11/17 09:31

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-5

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	7260		574	859	500	333	pCi/L	04/26/17 13:07	04/26/17 20:15	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	33.0		7.34	8.16	20.0	10.3	pCi/L	04/21/17 07:51	04/21/17 23:41	1

Client Sample ID: GW-06

Date Collected: 04/11/17 10:19

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-6

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	5310		500	684	500	331	pCi/L	04/26/17 13:07	04/26/17 20:38	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	20.0		6.88	7.21	20.0	10.3	pCi/L	04/21/17 07:51	04/22/17 00:47	1

Client Sample ID: GW-07

Date Collected: 04/11/17 10:44

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-7

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	4360		476	611	500	354	pCi/L	04/26/17 13:07	04/26/17 21:00	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	0.713	U	6.17	6.17	20.0	10.4	pCi/L	04/21/17 07:51	04/22/17 01:54	1

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Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Client Sample ID: GW-08

Date Collected: 04/11/17 11:30

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-8

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	3690		424	534	500	324	pCi/L	04/26/17 13:07	04/26/17 21:23	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	4.17	U	6.41	6.43	20.0	10.5	pCi/L	04/21/17 07:51	04/22/17 03:00	1

Client Sample ID: DUPLICATE

Date Collected: 04/11/17 00:00

Date Received: 04/11/17 13:00

Lab Sample ID: 160-21811-9

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	9720		671	1090	500	348	pCi/L	04/26/17 13:07	04/26/17 21:46	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	136		10.3	18.0	20.0	10.6	pCi/L	04/21/17 07:51	04/22/17 04:06	1

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Method: 906.0 - Tritium, Total (LSC)

Lab Sample ID: MB 160-305700/1-A

Matrix: Water

Analysis Batch: 305876

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 305700

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	49.85	U	194	194	500	340	pCi/L	04/26/17 13:07	04/26/17 17:14	1

Lab Sample ID: LCS 160-305700/2-A

Matrix: Water

Analysis Batch: 305876

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 305700

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	3880	3348		510	500	338	pCi/L	86	74 - 114

Lab Sample ID: 160-21811-2 MS

Matrix: Water

Analysis Batch: 305876

Client Sample ID: GW-02

Prep Type: Dissolved

Prep Batch: 305700

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	8100		3880	10740		1170	500	328	pCi/L	68	67 - 130

Lab Sample ID: 160-21811-1 DU

Matrix: Water

Analysis Batch: 305876

Client Sample ID: GW-01

Prep Type: Dissolved

Prep Batch: 305700

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tritium	3640		3468		517	500	330	pCi/L	0.17	1

Method: C-01-1 - Carbon-14 (EERF C-01-1)

Lab Sample ID: MB 160-304594/1-A

Matrix: Water

Analysis Batch: 305166

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 304594

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	0.4204	U	6.27	6.27	20.0	10.6	pCi/L	04/21/17 07:51	04/21/17 17:04	1

Lab Sample ID: LCS 160-304594/2-A

Matrix: Water

Analysis Batch: 305166

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 304594

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	1130	915.0		101	20.0	10.3	pCi/L	81	38 - 112

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QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) (Continued)

Lab Sample ID: 160-21811-9 MS

Matrix: Water

Analysis Batch: 305166

Client Sample ID: DUPLICATE

Prep Type: Dissolved

Prep Batch: 304594

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	136		1120	1184		130	20.0	10.4	pCi/L	93	37 - 121

Lab Sample ID: 160-21811-9 DU

Matrix: Water

Analysis Batch: 305166

Client Sample ID: DUPLICATE

Prep Type: Dissolved

Prep Batch: 304594

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Carbon-14	136		131.9		17.5	20.0	10.4	pCi/L	0.11	1

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Rad

Filtration Batch: 303476

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-21811-1	GW-01	Dissolved	Water	Filtration	
160-21811-2	GW-02	Dissolved	Water	Filtration	
160-21811-3	GW-03	Dissolved	Water	Filtration	
160-21811-4	GW-04	Dissolved	Water	Filtration	
160-21811-5	GW-05	Dissolved	Water	Filtration	
160-21811-6	GW-06	Dissolved	Water	Filtration	
160-21811-7	GW-07	Dissolved	Water	Filtration	
160-21811-8	GW-08	Dissolved	Water	Filtration	
160-21811-9	DUPLICATE	Dissolved	Water	Filtration	
160-21811-2 MS	GW-02	Dissolved	Water	Filtration	
160-21811-9 MS	DUPLICATE	Dissolved	Water	Filtration	
160-21811-1 DU	GW-01	Dissolved	Water	Filtration	
160-21811-9 DU	DUPLICATE	Dissolved	Water	Filtration	

Prep Batch: 304594

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-21811-1	GW-01	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-2	GW-02	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-3	GW-03	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-4	GW-04	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-5	GW-05	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-6	GW-06	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-7	GW-07	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-8	GW-08	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-9	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	303476
MB 160-304594/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-304594/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-21811-9 MS	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	303476
160-21811-9 DU	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	303476

Leach Batch: 305653

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-21811-1	GW-01	Dissolved	Water	Oxidation	303476
160-21811-2	GW-02	Dissolved	Water	Oxidation	303476
160-21811-3	GW-03	Dissolved	Water	Oxidation	303476
160-21811-4	GW-04	Dissolved	Water	Oxidation	303476
160-21811-5	GW-05	Dissolved	Water	Oxidation	303476
160-21811-6	GW-06	Dissolved	Water	Oxidation	303476
160-21811-7	GW-07	Dissolved	Water	Oxidation	303476
160-21811-8	GW-08	Dissolved	Water	Oxidation	303476
160-21811-9	DUPLICATE	Dissolved	Water	Oxidation	303476
160-21811-2 MS	GW-02	Dissolved	Water	Oxidation	303476
160-21811-1 DU	GW-01	Dissolved	Water	Oxidation	303476

Prep Batch: 305700

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-21811-1	GW-01	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-2	GW-02	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-3	GW-03	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-4	GW-04	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-5	GW-05	Dissolved	Water	LSC_Dist_Susp	305653

TestAmerica St. Louis

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-21811-1

Rad (Continued)

Prep Batch: 305700 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-21811-6	GW-06	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-7	GW-07	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-8	GW-08	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-9	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	305653
MB 160-305700/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-305700/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-21811-2 MS	GW-02	Dissolved	Water	LSC_Dist_Susp	305653
160-21811-1 DU	GW-01	Dissolved	Water	LSC_Dist_Susp	305653

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-23175-1

Client Project/Site: MA-15-028

For:

Decontamination Decommissioning and Envi
345 North Avenue, 2nd Floor
Wakefield, Massachusetts 01880

Attn: Matt Norton

Elizabeth M. Hoerchler

Authorized for release by:

8/4/2017 4:54:58 PM

Elizabeth Hoerchler, Project Mgmt. Assistant
(314)298-8566

elizabeth.hoerchler@testamericainc.com

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Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Job ID: 160-23175-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Decontamination Decommissioning and Envi

Project: MA-15-028

Report Number: 160-23175-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 07/07/2017; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 18.0° C.

TRITIUM

Samples GW-01 (160-23175-1), GW-02 (160-23175-2), GW-03 (160-23175-3), GW-04 (160-23175-4), GW-05 (160-23175-5), GW-06 (160-23175-6), GW-07 (160-23175-7), GW-08 (160-23175-8) and DUP (160-23175-9) were analyzed for Tritium in accordance with EPA Method 906.0. The samples were leached on 07/27/2017, prepared on 07/27/2017 and analyzed on 07/28/2017.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CARBON-14 BY LSC

Samples GW-01 (160-23175-1), GW-02 (160-23175-2), GW-03 (160-23175-3), GW-04 (160-23175-4), GW-05 (160-23175-5), GW-06 (160-23175-6), GW-07 (160-23175-7), GW-08 (160-23175-8) and DUP (160-23175-9) were analyzed for Carbon-14 by LSC in accordance with C_01_1. The samples were prepared on 07/31/2017 and analyzed on 08/03/2017 and 08/04/2017.

Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Job ID: 160-23175-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

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TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
Phone: 314.298.8566 Fax: 314.298.8757

Chain of Custody Record 199973

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.
TAL-8210 (0713)

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact		Project Manager:		Site Contact: Ryan F. Key		Date:		COC No:	
Company Name: PDGS		Tel/Fax:		Lab Contact:		Carrier:		Sampler:	
Address: 345 N. Ave. 2nd Floor		Analysis Turnaround Time		Perform MS / MSD (Y / N)		Walk-in Client:		For Lab Use Only:	
City/State/Zip: Wakefield, MA		<input type="checkbox"/> CALENDAR DAYS <input type="checkbox"/> WORKING DAYS		Filtered Sample (Y / N)		Lab Sampling:		Job / SDG No.:	
Phone:		TAT if different from Below		Sample Type (C=Comp, G=Grab)		Job / SDG No.:		Sample Specific Notes:	
Fax:		2 weeks		Sample Date		Sample Time		Sample Specific Notes:	
Project Name: MA-15-028		1 week		Sample Date		Sample Time		Sample Specific Notes:	
Site: Fort Mills		2 days		Sample Date		Sample Time		Sample Specific Notes:	
PO #		1 day		Sample Date		Sample Time		Sample Specific Notes:	
GW-01	7/6	18:00							Filter in Lab
GW-02	7/6	12:45							
GW-03	7/6	14:05							
GW-04	7/6	15:00							
GW-05	7/6	11:45							
GW-06	7/6	10:45							
GW-07	7/6	9:55							
GW-08	7/6	9:15							
DW	7/6	15:00							

Barcode: 160-23175 Chain of Custody

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other

Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Cooler Temp. (°C) Obs'd:		Corr'd:		Therm ID No.:	
Relinquished by: [Signature]	Company: GeoTech nology	Received by: [Signature]	Company: GeoTech nology	Received by: [Signature]	Company: GeoTech nology	Date/Time: 7/17/10	Date/Time: 7/17/10
Relinquished by: [Signature]	Company: GeoTech nology	Received by: [Signature]	Company: GeoTech nology	Received by: [Signature]	Company: GeoTech nology	Date/Time: 7/17/10	Date/Time: 7/17/10
Relinquished by: [Signature]	Company: GeoTech nology	Received by: [Signature]	Company: GeoTech nology	Received by: [Signature]	Company: GeoTech nology	Date/Time: 7/17/10	Date/Time: 7/17/10

Login Sample Receipt Checklist

Client: Decontamination Decommissioning and Envi

Job Number: 160-23175-1

Login Number: 23175

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian J

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Method	Method Description	Protocol	Laboratory
906.0	Tritium, Total (LSC)	EPA	TAL SL
C-01-1	Carbon-14 (EERF C-01-1)	EERF	TAL SL

Protocol References:

EERF = EERF

EPA = US Environmental Protection Agency

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-23175-1	GW-01	Water	07/06/17 18:00	07/07/17 10:45
160-23175-2	GW-02	Water	07/06/17 12:45	07/07/17 10:45
160-23175-3	GW-03	Water	07/06/17 14:05	07/07/17 10:45
160-23175-4	GW-04	Water	07/06/17 15:00	07/07/17 10:45
160-23175-5	GW-05	Water	07/06/17 11:45	07/07/17 10:45
160-23175-6	GW-06	Water	07/06/17 10:45	07/07/17 10:45
160-23175-7	GW-07	Water	07/06/17 09:55	07/07/17 10:45
160-23175-8	GW-08	Water	07/06/17 09:15	07/07/17 10:45
160-23175-9	DUP	Water	07/06/17 15:00	07/07/17 10:45

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Client Sample ID: GW-01

Date Collected: 07/06/17 18:00

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-1

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	4520		471	617	500	321	pCi/L	07/27/17 13:57	07/28/17 15:17	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	17.1		7.02	7.26	20.0	10.8	pCi/L	07/31/17 14:28	08/03/17 13:20	1

Client Sample ID: GW-02

Date Collected: 07/06/17 12:45

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-2

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	11000		708	1200	500	325	pCi/L	07/27/17 13:57	07/28/17 16:03	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	125		10.1	16.9	20.0	10.9	pCi/L	07/31/17 14:28	08/03/17 16:39	1

Client Sample ID: GW-03

Date Collected: 07/06/17 14:05

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-3

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	1260		290	310	500	320	pCi/L	07/27/17 13:57	07/28/17 16:48	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	505		16.8	57.0	20.0	10.7	pCi/L	07/31/17 14:28	08/03/17 17:45	1

Client Sample ID: GW-04

Date Collected: 07/06/17 15:00

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-4

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	8770		634	998	500	322	pCi/L	07/27/17 13:57	07/28/17 17:10	1

TestAmerica St. Louis

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	47.9		7.88	9.42	20.0	10.6	pCi/L	07/31/17 14:28	08/03/17 18:51	1

Client Sample ID: GW-05

Date Collected: 07/06/17 11:45

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-5

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	6960		580	844	500	333	pCi/L	07/27/17 13:57	07/28/17 17:33	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	28.5		7.32	7.94	20.0	10.6	pCi/L	07/31/17 14:28	08/03/17 19:57	1

Client Sample ID: GW-06

Date Collected: 07/06/17 10:45

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-6

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	5130		492	668	500	314	pCi/L	07/27/17 13:57	07/28/17 17:56	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	10.9		6.78	6.89	20.0	10.8	pCi/L	07/31/17 14:28	08/03/17 21:03	1

Client Sample ID: GW-07

Date Collected: 07/06/17 09:55

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-7

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	3770		434	547	500	318	pCi/L	07/27/17 13:57	07/28/17 18:18	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-4.14	U	6.24	6.26	20.0	10.8	pCi/L	07/31/17 14:28	08/03/17 22:10	1

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Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Client Sample ID: GW-08

Date Collected: 07/06/17 09:15

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-8

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	4650		476	628	500	320	pCi/L	07/27/17 13:57	07/28/17 18:41	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-2.37	U	6.14	6.14	20.0	10.5	pCi/L	07/31/17 14:28	08/03/17 23:16	1

Client Sample ID: DUP

Date Collected: 07/06/17 15:00

Date Received: 07/07/17 10:45

Lab Sample ID: 160-23175-9

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	7980		609	930	500	322	pCi/L	07/27/17 13:57	07/28/17 19:04	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	49.2		8.19	9.77	20.0	11.1	pCi/L	07/31/17 14:28	08/04/17 00:22	1

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Method: 906.0 - Tritium, Total (LSC)

Lab Sample ID: MB 160-319545/1-A
Matrix: Water
Analysis Batch: 319739

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 319545

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	159.8	U	193	194	500	320	pCi/L	07/27/17 13:57	07/28/17 14:32	1

Lab Sample ID: LCS 160-319545/2-A
Matrix: Water
Analysis Batch: 319739

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 319545

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	3820	3744		543	500	317	pCi/L	98	74 - 114

Lab Sample ID: 160-23175-2 MS
Matrix: Water
Analysis Batch: 319739

Client Sample ID: GW-02
Prep Type: Dissolved
Prep Batch: 319545

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	11000		3830	15490		1600	500	330	pCi/L	118	67 - 130

Lab Sample ID: 160-23175-1 DU
Matrix: Water
Analysis Batch: 319739

Client Sample ID: GW-01
Prep Type: Dissolved
Prep Batch: 319545

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tritium	4520		4213		582	500	309	pCi/L	0.26	1

Method: C-01-1 - Carbon-14 (EERF C-01-1)

Lab Sample ID: MB 160-320027/1-A
Matrix: Water
Analysis Batch: 320719

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 320027

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	-4.865	U	6.33	6.35	20.0	11.1	pCi/L	07/31/17 14:28	08/03/17 11:08	1

Lab Sample ID: LCS 160-320027/2-A
Matrix: Water
Analysis Batch: 320719

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 320027

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	1130	1032		114	20.0	11.0	pCi/L	92	38 - 112

TestAmerica St. Louis

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) (Continued)

Lab Sample ID: 160-23175-1 MS

Matrix: Water

Analysis Batch: 320719

Client Sample ID: GW-01

Prep Type: Dissolved

Prep Batch: 320027

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	17.1		1130	932.9		103	20.0	10.9	pCi/L	81	37 - 121

Lab Sample ID: 160-23175-1 DU

Matrix: Water

Analysis Batch: 320719

Client Sample ID: GW-01

Prep Type: Dissolved

Prep Batch: 320027

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Carbon-14	17.1		18.23		7.43	20.0	11.0	pCi/L	0.08	1

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Rad

Filtration Batch: 317092

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-23175-1	GW-01	Dissolved	Water	Filtration	
160-23175-1	GW-01	Dissolved	Water	Filtration	
160-23175-2	GW-02	Dissolved	Water	Filtration	
160-23175-2	GW-02	Dissolved	Water	Filtration	
160-23175-3	GW-03	Dissolved	Water	Filtration	
160-23175-3	GW-03	Dissolved	Water	Filtration	
160-23175-4	GW-04	Dissolved	Water	Filtration	
160-23175-4	GW-04	Dissolved	Water	Filtration	
160-23175-5	GW-05	Dissolved	Water	Filtration	
160-23175-5	GW-05	Dissolved	Water	Filtration	
160-23175-6	GW-06	Dissolved	Water	Filtration	
160-23175-6	GW-06	Dissolved	Water	Filtration	
160-23175-7	GW-07	Dissolved	Water	Filtration	
160-23175-7	GW-07	Dissolved	Water	Filtration	
160-23175-8	GW-08	Dissolved	Water	Filtration	
160-23175-8	GW-08	Dissolved	Water	Filtration	
160-23175-9	DUP	Dissolved	Water	Filtration	
160-23175-9	DUP	Dissolved	Water	Filtration	
160-23175-1 MS	GW-01	Dissolved	Water	Filtration	
160-23175-2 MS	GW-02	Dissolved	Water	Filtration	
160-23175-1 DU	GW-01	Dissolved	Water	Filtration	
160-23175-1 DU	GW-01	Dissolved	Water	Filtration	

Leach Batch: 319538

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-23175-1	GW-01	Dissolved	Water	Oxidation	317092
160-23175-2	GW-02	Dissolved	Water	Oxidation	317092
160-23175-3	GW-03	Dissolved	Water	Oxidation	317092
160-23175-4	GW-04	Dissolved	Water	Oxidation	317092
160-23175-5	GW-05	Dissolved	Water	Oxidation	317092
160-23175-6	GW-06	Dissolved	Water	Oxidation	317092
160-23175-7	GW-07	Dissolved	Water	Oxidation	317092
160-23175-8	GW-08	Dissolved	Water	Oxidation	317092
160-23175-9	DUP	Dissolved	Water	Oxidation	317092
160-23175-2 MS	GW-02	Dissolved	Water	Oxidation	317092
160-23175-1 DU	GW-01	Dissolved	Water	Oxidation	317092

Prep Batch: 319545

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-23175-1	GW-01	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-2	GW-02	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-3	GW-03	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-4	GW-04	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-5	GW-05	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-6	GW-06	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-7	GW-07	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-8	GW-08	Dissolved	Water	LSC_Dist_Susp	319538
160-23175-9	DUP	Dissolved	Water	LSC_Dist_Susp	319538
MB 160-319545/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-319545/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-23175-2 MS	GW-02	Dissolved	Water	LSC_Dist_Susp	319538

TestAmerica St. Louis

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-23175-1

Rad (Continued)

Prep Batch: 319545 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-23175-1 DU	GW-01	Dissolved	Water	LSC_Dist_Susp	319538

Prep Batch: 320027

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-23175-1	GW-01	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-2	GW-02	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-3	GW-03	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-4	GW-04	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-5	GW-05	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-6	GW-06	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-7	GW-07	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-8	GW-08	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-9	DUP	Dissolved	Water	LSC_Dist_Susp	317092
MB 160-320027/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-320027/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-23175-1 MS	GW-01	Dissolved	Water	LSC_Dist_Susp	317092
160-23175-1 DU	GW-01	Dissolved	Water	LSC_Dist_Susp	317092

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-27599-1

Client Project/Site: MA-15-028

For:

Decontamination Decommissioning and Envi
345 North Avenue, 2nd Floor
Wakefield, Massachusetts 01880

Attn: Matt Norton

Elizabeth M. Hoerchler

Authorized for release by:

4/30/2018 3:04:13 PM

Elizabeth Hoerchler, Project Manager I
(314)298-8566

elizabeth.hoerchler@testamericainc.com

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Job ID: 160-27599-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Decontamination Decommissioning and Envi

Project: MA-15-028

Report Number: 160-27599-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client.

Any minimum detectable concentration (MDC), critical value (DLC), or Safe Drinking Water Act detection limit (SDWA DL) is sample-specific unless otherwise stated elsewhere in this narrative.

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 04/03/2018; the samples arrived in good condition, properly preserved. The temperature of the coolers at receipt was 14.3° C.

TRITIUM

Samples MW 5 (160-27599-1), MW 6 (160-27599-2), MW 2 (160-27599-3), MW 3 (160-27599-4), MW 4 (160-27599-5), MW 1 (160-27599-6), MW 8 (160-27599-7), DUPLICATE (160-27599-8) and MW 7 (160-27599-9) were analyzed for Tritium in accordance with

Case Narrative

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Job ID: 160-27599-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

EPA Method 906.0. The samples were leached on 04/26/2018, prepared on 04/26/2018 and analyzed on 04/26/2018 and 04/27/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CARBON-14 BY LSC

Samples MW 5 (160-27599-1), MW 6 (160-27599-2), MW 2 (160-27599-3), MW 3 (160-27599-4), MW 4 (160-27599-5), MW 1 (160-27599-6), MW 8 (160-27599-7), DUPLICATE (160-27599-8) and MW 7 (160-27599-9) were analyzed for Carbon-14 by LSC in accordance with C_01_1. The samples were prepared on 04/23/2018 and analyzed on 04/24/2018 and 04/25/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Ver: 08/04/2016

Login Sample Receipt Checklist

Client: Decontamination Decommissioning and Envi

Job Number: 160-27599-1

Login Number: 27599

List Number: 1

Creator: Taylor, Kristene N

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is \leq background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is $<6\text{mm}$ (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Method	Method Description	Protocol	Laboratory
906.0	Tritium, Total (LSC)	EPA	TAL SL
C-01-1	Carbon-14 (EERF C-01-1)	EERF	TAL SL
Filtration	Sample Filtration	None	TAL SL
LSC_Dist_Susp	Distillation and Suspension (LSC)	None	TAL SL
Oxidation	Oxidation Prep (Tritium)	None	TAL SL

Protocol References:

EERF = EERF

EPA = US Environmental Protection Agency

None = None

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-27599-1	MW 5	Water	04/03/18 09:30	04/03/18 15:08
160-27599-2	MW 6	Water	04/03/18 10:15	04/03/18 15:08
160-27599-3	MW 2	Water	04/03/18 10:45	04/03/18 15:08
160-27599-4	MW 3	Water	04/03/18 11:15	04/03/18 15:08
160-27599-5	MW 4	Water	04/03/18 12:00	04/03/18 15:08
160-27599-6	MW 1	Water	04/03/18 12:50	04/03/18 15:08
160-27599-7	MW 8	Water	04/03/18 13:45	04/03/18 15:08
160-27599-8	DUPLICATE	Water	04/03/18 14:30	04/03/18 15:08
160-27599-9	MW 7	Water	04/03/18 14:30	04/03/18 15:08

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Client Sample ID: MW 5
Date Collected: 04/03/18 09:30
Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-1
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	5160		510	683	500	369	pCi/L	04/26/18 11:49	04/26/18 20:48	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	22.3		7.03	7.43	20.0	10.5	pCi/L	04/23/18 01:03	04/24/18 15:03	1

Client Sample ID: MW 6
Date Collected: 04/03/18 10:15
Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-2
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	5840		516	728	500	343	pCi/L	04/26/18 11:49	04/26/18 21:30	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	12.9		6.70	6.84	20.0	10.6	pCi/L	04/23/18 01:03	04/24/18 18:24	1

Client Sample ID: MW 2
Date Collected: 04/03/18 10:45
Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-3
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	6440		562	798	500	371	pCi/L	04/26/18 11:49	04/26/18 22:12	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	68.6		8.55	11.3	20.0	10.6	pCi/L	04/23/18 01:03	04/24/18 19:31	1

Client Sample ID: MW 3
Date Collected: 04/03/18 11:15
Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-4
Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	1130		293	309	500	359	pCi/L	04/26/18 11:49	04/26/18 22:33	1

TestAmerica St. Louis

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	514		17.2	58.1	20.0	10.5	pCi/L	04/23/18 01:03	04/24/18 20:38	1

Client Sample ID: MW 4

Date Collected: 04/03/18 12:00

Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-5

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	9500		653	1060	500	354	pCi/L	04/26/18 11:49	04/26/18 22:54	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	73.4		8.76	11.8	20.0	10.8	pCi/L	04/23/18 01:03	04/24/18 21:45	1

Client Sample ID: MW 1

Date Collected: 04/03/18 12:50

Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-6

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	2600		377	441	500	349	pCi/L	04/26/18 11:49	04/26/18 23:15	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	21.4		7.02	7.39	20.0	10.6	pCi/L	04/23/18 01:03	04/24/18 22:52	1

Client Sample ID: MW 8

Date Collected: 04/03/18 13:45

Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-7

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	4710		473	629	500	345	pCi/L	04/26/18 11:49	04/26/18 23:36	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	22.3		7.04	7.44	20.0	10.5	pCi/L	04/23/18 01:03	04/24/18 23:59	1

TestAmerica St. Louis

Client Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Client Sample ID: DUPLICATE

Date Collected: 04/03/18 14:30

Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-8

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	2430		357	416	500	332	pCi/L	04/26/18 11:49	04/26/18 23:57	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	15.8		6.87	7.08	20.0	10.7	pCi/L	04/23/18 01:03	04/25/18 01:06	1

Client Sample ID: MW 7

Date Collected: 04/03/18 14:30

Date Received: 04/03/18 15:08

Lab Sample ID: 160-27599-9

Matrix: Water

Method: 906.0 - Tritium, Total (LSC) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	2440		362	421	500	338	pCi/L	04/26/18 11:49	04/27/18 00:18	1

Method: C-01-1 - Carbon-14 (EERF C-01-1) - Dissolved

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	1.80	U	6.27	6.28	20.0	10.6	pCi/L	04/23/18 01:03	04/25/18 02:13	1

TestAmerica St. Louis

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Method: 906.0 - Tritium, Total (LSC)

Lab Sample ID: MB 160-362928/1-A

Matrix: Water

Analysis Batch: 363117

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 362928

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Tritium	129.7	U	203	204	500	341	pCi/L	04/26/18 11:49	04/26/18 20:07	1

Lab Sample ID: LCS 160-362928/2-A

Matrix: Water

Analysis Batch: 363117

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 362928

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	3670	3196		496	500	350	pCi/L	87	74 - 114

Lab Sample ID: 160-27599-2 MS

Matrix: Water

Analysis Batch: 363117

Client Sample ID: MW 6

Prep Type: Dissolved

Prep Batch: 362928

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Tritium	5840		3690	8601		977	500	349	pCi/L	75	67 - 130

Lab Sample ID: 160-27599-1 DU

Matrix: Water

Analysis Batch: 363117

Client Sample ID: MW 5

Prep Type: Dissolved

Prep Batch: 362928

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Tritium	5160		5454		710	500	370	pCi/L	0.21	1

Method: C-01-1 - Carbon-14 (EERF C-01-1)

Lab Sample ID: MB 160-362099/1-A

Matrix: Water

Analysis Batch: 362778

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 362099

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Carbon-14	9.249	U	6.57	6.64	20.0	10.6	pCi/L	04/23/18 01:03	04/24/18 12:50	1

Lab Sample ID: LCS 160-362099/2-A

Matrix: Water

Analysis Batch: 362778

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 362099

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	1130	844.6		93.7	20.0	10.6	pCi/L	75	38 - 112

TestAmerica St. Louis

QC Sample Results

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Method: C-01-1 - Carbon-14 (EERF C-01-1) (Continued)

Lab Sample ID: 160-27599-1 MS

Matrix: Water

Analysis Batch: 362778

Client Sample ID: MW 5

Prep Type: Dissolved

Prep Batch: 362099

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Carbon-14	22.3		1120	1234		136	20.0	10.6	pCi/L	108	37 - 121

Lab Sample ID: 160-27599-1 DU

Matrix: Water

Analysis Batch: 362778

Client Sample ID: MW 5

Prep Type: Dissolved

Prep Batch: 362099

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Carbon-14	22.3		38.58		8.67	20.0	10.6	pCi/L	1.01	1

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Rad

Filtration Batch: 359019

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-27599-1	MW 5	Dissolved	Water	Filtration	
160-27599-1	MW 5	Dissolved	Water	Filtration	
160-27599-2	MW 6	Dissolved	Water	Filtration	
160-27599-3	MW 2	Dissolved	Water	Filtration	
160-27599-4	MW 3	Dissolved	Water	Filtration	
160-27599-5	MW 4	Dissolved	Water	Filtration	
160-27599-6	MW 1	Dissolved	Water	Filtration	
160-27599-7	MW 8	Dissolved	Water	Filtration	
160-27599-8	DUPLICATE	Dissolved	Water	Filtration	
160-27599-9	MW 7	Dissolved	Water	Filtration	
160-27599-1 MS	MW 5	Dissolved	Water	Filtration	
160-27599-2 MS	MW 6	Dissolved	Water	Filtration	
160-27599-1 DU	MW 5	Dissolved	Water	Filtration	
160-27599-1 DU	MW 5	Dissolved	Water	Filtration	

Prep Batch: 362099

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-27599-1	MW 5	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-2	MW 6	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-3	MW 2	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-4	MW 3	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-5	MW 4	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-6	MW 1	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-7	MW 8	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-8	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-9	MW 7	Dissolved	Water	LSC_Dist_Susp	359019
MB 160-362099/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-362099/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-27599-1 MS	MW 5	Dissolved	Water	LSC_Dist_Susp	359019
160-27599-1 DU	MW 5	Dissolved	Water	LSC_Dist_Susp	359019

Leach Batch: 362844

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-27599-1	MW 5	Dissolved	Water	Oxidation	359019
160-27599-2	MW 6	Dissolved	Water	Oxidation	359019
160-27599-3	MW 2	Dissolved	Water	Oxidation	359019
160-27599-4	MW 3	Dissolved	Water	Oxidation	359019
160-27599-5	MW 4	Dissolved	Water	Oxidation	359019
160-27599-6	MW 1	Dissolved	Water	Oxidation	359019
160-27599-7	MW 8	Dissolved	Water	Oxidation	359019
160-27599-8	DUPLICATE	Dissolved	Water	Oxidation	359019
160-27599-9	MW 7	Dissolved	Water	Oxidation	359019
160-27599-2 MS	MW 6	Dissolved	Water	Oxidation	359019
160-27599-1 DU	MW 5	Dissolved	Water	Oxidation	359019

Prep Batch: 362928

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-27599-1	MW 5	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-2	MW 6	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-3	MW 2	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-4	MW 3	Dissolved	Water	LSC_Dist_Susp	362844

TestAmerica St. Louis

QC Association Summary

Client: Decontamination Decommissioning and Envi
Project/Site: MA-15-028

TestAmerica Job ID: 160-27599-1

Rad (Continued)

Prep Batch: 362928 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-27599-5	MW 4	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-6	MW 1	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-7	MW 8	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-8	DUPLICATE	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-9	MW 7	Dissolved	Water	LSC_Dist_Susp	362844
MB 160-362928/1-A	Method Blank	Total/NA	Water	LSC_Dist_Susp	
LCS 160-362928/2-A	Lab Control Sample	Total/NA	Water	LSC_Dist_Susp	
160-27599-2 MS	MW 6	Dissolved	Water	LSC_Dist_Susp	362844
160-27599-1 DU	MW 5	Dissolved	Water	LSC_Dist_Susp	362844

Summary : RESRAD Default Parameters

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Summary : RESRAD Default Parameters

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Dose Conversion Factor (and Related) Parameter Summary

Dose Library: DCFPAK3.02 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	C-14 (Source: DCFPAK3.02)	1.106E-05	1.106E-05	DCF1(1)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	C-14(p) (Class: S)	2.120E-05	2.120E-05	DCF2(1)
B-1	C-14(g) (Class: G Dioxide)	2.310E-08	2.310E-08	C14GInhDCF
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	C-14	2.150E-06	2.150E-06	DCF3(1)
D-34	Food transfer factors:			
D-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(1,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(1,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(1,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(1,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.200E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	6.000E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): C-14	4.010E+02	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W1(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.200E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.000E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.040E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	3.700E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	5.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.600E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.150E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	8.000E-01	0.000E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	8.000E-01	0.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.054E-01	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSNI
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSNI
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND C14 V2.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND C14 V2.RAD

Contaminated Zone Dimensions

Initial Soil Concentrations, pCi/g

Area: 4200.00 square meters
 Thickness: 3.00 meters
 Cover Depth: 0.00 meters

C-14 4.010E+02

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.731E-02	2.687E-03	2.590E-05	2.366E+01	2.183E-17	0.000E+00	0.000E+00	0.000E+00
M(t):	1.092E-03	1.075E-04	1.036E-06	9.463E-01	8.733E-19	0.000E+00	0.000E+00	0.000E+00

Maximum TDOSE(t): 2.492E+01 mrem/yr at t = 11.55 ± 0.02 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.155E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	6.303E-16	0.0000	5.143E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.986E-15	0.0000
Total	6.303E-16	0.0000	5.143E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.986E-15	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.155E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	2.492E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.492E+01	1.0000
Total	2.492E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.492E+01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	2.965E-04	0.0109	2.419E-02	0.8860	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.816E-03	0.1031
Total	2.965E-04	0.0109	2.419E-02	0.8860	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.816E-03	0.1031

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.731E-02	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.731E-02	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND C14 V2.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	2.918E-05	0.0109	2.381E-03	0.8860	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.771E-04	0.1031
Total	2.918E-05	0.0109	2.381E-03	0.8860	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.771E-04	0.1031

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.687E-03	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.687E-03	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND C14 V2.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	2.813E-07	0.0109	2.295E-05	0.8860	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.671E-06	0.1031
Total	2.813E-07	0.0109	2.295E-05	0.8860	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.671E-06	0.1031

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.590E-05	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.590E-05	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	2.361E-14	0.0000	1.926E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.242E-13	0.0000
Total	2.361E-14	0.0000	1.926E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.242E-13	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	2.366E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.366E+01	1.0000
Total	2.366E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.366E+01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	2.183E-17	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.183E-17	1.0000
Total	2.183E-17	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.183E-17	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND C14 V2.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	6.810E-05	6.701E-06	6.459E-08	5.900E-02	5.445E-20	0.000E+00	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14		3.671E+05	3.731E+06	3.870E+08	4.238E+02	*4.479E+12	*4.479E+12	*4.479E+12	*4.479E+12

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 11.55 ± 0.02 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
C-14	4.010E+02	11.55 ± 0.02	6.214E-02	4.023E+02	6.214E-02	4.023E+02

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND C14 V2.RAD

Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	2.731E-02	2.687E-03	2.590E-05	2.366E+01	2.183E-17	0.000E+00	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration

Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	4.010E+02	3.948E+01	3.809E-01	3.207E-08	1.310E-28	0.000E+00	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 0.42 seconds

Summary : RESRAD Default Parameters

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Summary : RESRAD Default Parameters

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Dose Conversion Factor (and Related) Parameter Summary

Dose Library: DCFPAK3.02 (Adult)

		Current	Base	Parameter
Menu	Parameter	Value#	Case*	Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	H-3 (Source: DCFPAK3.02)	0.000E+00	0.000E+00	DCF1(1)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	H-3	9.689E-07	9.689E-07	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	H-3	1.550E-07	1.550E-07	DCF3(1)
D-34	Food transfer factors:			
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(1,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(1,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(1,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary

	User	Used by RESRAD	Parameter		
Menu	Parameter	Input	Default (If different from user input)	Name	
R011	Area of contaminated zone (m**2)	4.200E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	6.000E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T (2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T (3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T (4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T (5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T (6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T (7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T (8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T (9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): H-3	7.220E+02	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.200E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.000E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.040E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	3.700E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	5.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.600E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.150E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

	User	Used by RESRAD	Parameter		
Menu	Parameter	Input	Default	(If different from user input)	Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.371E-01	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD SHAPE(12)

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

		User	Used by RESRAD	Parameter		
Menu	Parameter	Input	Default	(If different from user input)	Name	
R017	Fractions of annular areas within AREA:					
R017	Ring 1	not used	1.000E+00	---	FRACA(1)	
R017	Ring 2	not used	2.732E-01	---	FRACA(2)	
R017	Ring 3	not used	0.000E+00	---	FRACA(3)	
R017	Ring 4	not used	0.000E+00	---	FRACA(4)	
R017	Ring 5	not used	0.000E+00	---	FRACA(5)	
R017	Ring 6	not used	0.000E+00	---	FRACA(6)	
R017	Ring 7	not used	0.000E+00	---	FRACA(7)	
R017	Ring 8	not used	0.000E+00	---	FRACA(8)	
R017	Ring 9	not used	0.000E+00	---	FRACA(9)	
R017	Ring 10	not used	0.000E+00	---	FRACA(10)	
R017	Ring 11	not used	0.000E+00	---	FRACA(11)	
R017	Ring 12	not used	0.000E+00	---	FRACA(12)	
R018	Fruits, vegetables and grain consumption (kg/yr)		not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)		not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)		not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)		not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)		not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)		not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)		3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)		5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water		1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water		not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water		not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water		not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food		not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food		not used	-1	---	FPLANT
R018	Contamination fraction of meat		not used	-1	---	FMEAT
R018	Contamination fraction of milk		not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)		not used	6.800E+01	---	LF15
R019	Livestock fodder intake for milk (kg/day)		not used	5.500E+01	---	LF16
R019	Livestock water intake for meat (L/day)		not used	5.000E+01	---	LW15
R019	Livestock water intake for milk (L/day)		not used	1.600E+02	---	LW16
R019	Livestock soil intake (kg/day)		not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)		not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)		1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)		not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water		1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water		not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water		not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water		not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)		not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)		not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)		not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)		not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)		not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)		not used	8.000E-02	---	TE(3)

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

	User	Used by RESRAD	Parameter	
Menu	Parameter	Input	Default (If different from user input)	Name
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	--- TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	--- TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	--- TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	--- RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	--- RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	--- RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	--- RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	--- RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	--- RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	--- WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	--- C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	--- C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	--- CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	--- CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	--- DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	--- EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	--- REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	--- AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	--- AVFG5
STOR	Storage times of contaminated foodstuffs (days):			
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	--- STOR T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	--- STOR T(2)
STOR	Milk	1.000E+00	1.000E+00	--- STOR T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	--- STOR T(4)
STOR	Fish	7.000E+00	7.000E+00	--- STOR T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	--- STOR T(6)
STOR	Well water	1.000E+00	1.000E+00	--- STOR T(7)
STOR	Surface water	1.000E+00	1.000E+00	--- STOR T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	--- STOR T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	--- FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	--- DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	--- TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	--- TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	--- PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	--- PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):			
R021	in cover material	not used	2.000E-06	--- DIFCV
R021	in foundation material	not used	3.000E-07	--- DIFFL
R021	in contaminated zone soil	not used	2.000E-06	--- DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	--- HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	--- REXG
R021	Height of the building (room) (m)	not used	2.500E+00	--- HRM
R021	Building interior area factor	not used	0.000E+00	--- FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	--- DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	--- EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	--- EMANA(2)
TITL	Number of graphical time points	32	---	--- NPTS

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

	User	Used by RESRAD			Parameter	
Menu	Parameter	Input	Default	(If different from user input)	Name	
TITL	Maximum number of integration points for dose		17	---	---	LYMAX
TITL	Maximum number of integration points for risk		257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Summary : RESRAD Default Parameters

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Contaminated Zone Dimensions	Initial Soil Concentrations, pCi/g
Area: 4200.00 square meters	H-3 7.220E+02
Thickness: 3.00 meters	
Cover Depth: 0.00 meters	

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years): 0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 1.000E+02 3.000E+02 1.000E+03

TDOSE(t): 9.049E-01 4.203E-01 2.165E+01 2.156E-01 1.605E-09 0.000E+00 0.000E+00 0.000E+00

M(t): 3.620E-02 1.681E-02 8.660E-01 8.623E-03 6.421E-11 0.000E+00 0.000E+00 0.000E+00

Maximum TDOSE(t): 2.496E+01 mrem/yr at t = 4.353 ± 0.009 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 4.353E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Radio-							
Nuclide mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
Nuclide							
H-3	0.000E+00 0.0000	1.564E-02 0.0006	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000
Total	0.000E+00 0.0000	1.564E-02 0.0006	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 4.353E+00 years

Water Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
Radio-							
Nuclide mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
Nuclide							
H-3	2.495E+01 0.9994	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000
Total	2.495E+01 0.9994	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 0.000E+00 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil								
Radio-															
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	0.000E+00	0.0000	9.043E-01	0.9993	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.114E-04	0.0007	
Total	0.000E+00	0.0000	9.043E-01	0.9993	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.114E-04	0.0007	

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 0.000E+00 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*								
Radio-															
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.049E-01	1.0000	
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.049E-01	1.0000	

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+00 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	0.000E+00	0.0000	3.562E-01	0.8475	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.408E-04 0.0006
Total	0.000E+00	0.0000	3.562E-01	0.8475	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.408E-04 0.0006

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+00 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	6.384E-02	0.1519	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.203E-01 1.0000
Total	6.384E-02	0.1519	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.203E-01 1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default ParametersFile : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RADTotal Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 3.000E+00 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	0.000E+00	0.0000	5.524E-02	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.734E-05 0.0000
Total	0.000E+00	0.0000	5.524E-02	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.734E-05 0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 3.000E+00 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	2.159E+01	0.9974	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.165E+01 1.0000
Total	2.159E+01	0.9974	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.165E+01 1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+01 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	0.000E+00	0.0000	8.033E-05	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.431E-08 0.0000
Total	0.000E+00	0.0000	8.033E-05	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.431E-08 0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+01 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	2.155E-01	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.156E-01 1.0000
Total	2.155E-01	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.156E-01 1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default ParametersFile : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RADTotal Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 3.000E+01 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	0.000E+00	0.0000	5.801E-13	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.922E-16 0.0000
Total	0.000E+00	0.0000	5.801E-13	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.922E-16 0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 3.000E+01 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
H-3	1.605E-09	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.605E-09 1.0000
Total	1.605E-09	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.605E-09 1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+02 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+02 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 3.000E+02 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 3.000E+02 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+03 yearsWater Independent Pathways (Inhalation excludes radon)

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)As mrem/yr and Fraction of Total Dose At t = 1.000E+03 yearsWater Dependent Pathways

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*						
Radio-													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RAD

Dose/Source Ratios Summed Over All Pathways

Parent and Progeny Principal Radionuclide Contributions Indicated

Parent	Product	Thread	DSR(i,t) At Time in Years (mrem/yr)/(pCi/g)						
(i)	(j)	Fraction	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02 1.000E+03
H-3	H-3	1.000E+00	1.253E-03	5.822E-04	2.999E-02	2.986E-04	2.223E-12	3.037E-41	0.000E+00 0.000E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide

(i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
H-3		1.995E+04	4.294E+04	8.337E+02	8.373E+04	1.124E+13	*9.621E+15	*9.621E+15	*9.621E+15

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)

and Single Radionuclide Soil Guidelines G(i,t) in pCi/g

at tmin = time of minimum single radionuclide soil guideline

and at tmax = time of maximum total dose = 4.353 ± 0.009 years

Nuclide	Initial	tmin	DSR(i,tmin)	G(i,tmin)	DSR(i,tmax)	G(i,tmax)
(i)	(pCi/g)	(years)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
H-3	7.220E+02	4.353 ± 0.009	3.457E-02	7.231E+02	3.457E-02	7.231E+02

Summary : RESRAD Default ParametersFile : E:\FMS RESRAD\FMS SURFACE TO 3 M SITE SPECIFIC DCGL 2017V2 IND H3.RADIndividual Nuclide Dose Summed Over All PathwaysParent Nuclide and Branch Fraction Indicated

Nuclide Parent		THF(i)	DOSE(j,t), mrem/yr							
(j)	(i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
H-3	H-3	1.000E+00	9.049E-01	4.203E-01	2.165E+01	2.156E-01	1.605E-09	0.000E+00	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil ConcentrationParent Nuclide and Branch Fraction Indicated

Nuclide Parent		THF(i)	S(j,t), pCi/g							
(j)	(i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
H-3	H-3	1.000E+00	7.220E+02	2.845E+02	4.412E+01	6.422E-02	4.649E-10	5.722E-39	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 0.80 seconds

Dose Conversion Factor (and Related) Parameter Summary ...	2
Site-Specific Parameter Summary	3
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Contaminated Zone and Total Dose Summary	8
Total Dose Components	
Time = 0.000E+00	9
Time = 1.000E+00	10
Time = 3.000E+00	11
Time = 1.000E+01	12
Time = 3.000E+01	13
Time = 1.000E+02	14
Time = 3.000E+02	15
Time = 1.000E+03	16
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Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Dose Conversion Factor (and Related) Parameter Summary

Dose Library: DCFPAK3.02 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1 DCF's for external ground radiation, (mrem/yr)/(pCi/g)				
A-1	C-14 (Source: DCFPAK3.02)	1.106E-05	1.106E-05	DCF1(1)
B-1 Dose conversion factors for inhalation, mrem/pCi:				
B-1	C-14(p) (Class: S)	2.120E-05	2.120E-05	DCF2(1)
B-1	C-14(g) (Class: G Dioxide)	2.310E-08	2.310E-08	C14GInhDCF
D-1 Dose conversion factors for ingestion, mrem/pCi:				
D-1	C-14	2.150E-06	2.150E-06	DCF3(1)
D-34 Food transfer factors:				
D-34	C-14, plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(1,1)
D-34	C-14, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(1,2)
D-34	C-14, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,3)
D-5 Bioaccumulation factors, fresh water, L/kg:				
D-5	C-14, fish	5.000E+04	5.000E+04	BIOFAC(1,1)
D-5	C-14, crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(1,2)

#####

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.200E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	6.000E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): C-14	4.010E+02	0.000E+00	---	SI(1)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	WI(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.200E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.000E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.040E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	4.300E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	3.700E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	5.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.600E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.150E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.750E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
3 3 3 3 3					
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	8.000E-01	0.000E+00	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.054E-01	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
3 3 3 3 3					
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
3 3 3 3 3					

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Used by RESRAD Default (If different from user input)	Parameter Name
R017 Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	FRACA(1)
R017	Ring 2	not used	2.732E-01	FRACA(2)
R017	Ring 3	not used	0.000E+00	FRACA(3)
R017	Ring 4	not used	0.000E+00	FRACA(4)
R017	Ring 5	not used	0.000E+00	FRACA(5)
R017	Ring 6	not used	0.000E+00	FRACA(6)
R017	Ring 7	not used	0.000E+00	FRACA(7)
R017	Ring 8	not used	0.000E+00	FRACA(8)
R017	Ring 9	not used	0.000E+00	FRACA(9)
R017	Ring 10	not used	0.000E+00	FRACA(10)
R017	Ring 11	not used	0.000E+00	FRACA(11)
R017	Ring 12	not used	0.000E+00	FRACA(12)
R018 Fruits, vegetables and grain consumption (kg/yr)				
R018	Leafy vegetable consumption (kg/yr)	not used	1.600E+02	DIET(1)
R018	Milk consumption (L/yr)	not used	1.400E+01	DIET(2)
R018	Meat and poultry consumption (kg/yr)	not used	9.200E+01	DIET(3)
R018	Fish consumption (kg/yr)	not used	6.300E+01	DIET(4)
R018	Other seafood consumption (kg/yr)	not used	5.400E+00	DIET(5)
R018	Soil ingestion rate (g/yr)	not used	9.000E-01	DIET(6)
R018	Drinking water intake (L/yr)	3.650E+01	3.650E+01	SOIL
R018	Contamination fraction of drinking water	5.100E+02	5.100E+02	DWI
R018	Contamination fraction of household water	1.000E+00	1.000E+00	FDW
R018	Contamination fraction of livestock water	not used	1.000E+00	FHHW
R018	Contamination fraction of irrigation water	not used	1.000E+00	FLW
R018	Contamination fraction of aquatic food	not used	1.000E+00	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	FR9
R018	Contamination fraction of plant food	not used	-1	FPLANT
R018	Contamination fraction of meat	not used	-1	FMEAT
R018	Contamination fraction of milk	not used	-1	FMILK
R019 Livestock fodder intake for meat (kg/day)				
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	DM
R019	Depth of roots (m)	not used	9.000E-01	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	FGWIR
R19B Wet weight crop yield for Non-Leafy (kg/m**2)				
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	TE(3)

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name

R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM

C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSNI
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSNI
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5

STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)

R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

TITL	Number of graphical time points	32	---	---	NPTS

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Contaminated Zone Dimensions	Initial Soil Concentrations, pCi/g
AAAAAA	AAAAAA
Area: 4200.00 square meters	C-14 4.010E+02
Thickness: 3.00 meters	
Cover Depth: 0.00 meters	

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

AAAAAA

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.437E-02	1.294E-01	2.417E+01	2.042E-04	9.810E-25	0.000E+00	0.000E+00	0.000E+00
M(t):	5.747E-04	5.175E-03	9.667E-01	8.167E-06	3.924E-26	0.000E+00	0.000E+00	0.000E+00

Maximum TDOSE(t): 2.494E+01 mrem/yr at t = 4.352 ñ 0.009 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 4.352E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
C-14	1.217E-08	0.0000	4.617E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.156E-07	0.0000
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	1.217E-08	0.0000	4.617E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.156E-07	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 4.352E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
C-14	2.494E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.494E+01	1.0000
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.494E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.494E+01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	2.965E-04	0.0206	1.125E-02	0.7833	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.816E-03	0.1960
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	2.965E-04	0.0206	1.125E-02	0.7833	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.816E-03	0.1960

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.437E-02	1.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.437E-02	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	2.916E-05	0.0002	1.107E-03	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.770E-04	0.0021
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.916E-05	0.0002	1.107E-03	0.0086	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.770E-04	0.0021

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	1.280E-01	0.9891	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.294E-01	1.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.280E-01	0.9891	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.294E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	2.813E-07	0.0000	1.067E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.671E-06	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	2.813E-07	0.0000	1.067E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.671E-06	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	2.417E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.417E+01	1.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	2.417E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.417E+01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	2.361E-14	0.0000	8.958E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.242E-13	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	2.361E-14	0.0000	8.958E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.242E-13	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	2.042E-04	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.042E-04	1.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	2.042E-04	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.042E-04	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	9.810E-25	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.810E-25	1.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	9.810E-25	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.810E-25	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	3.583E-05	3.226E-04	6.027E-02	5.092E-07	2.446E-27	0.000E+00	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life 6 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	6.978E+05	7.749E+04	4.148E+02	4.910E+07	*4.479E+12	*4.479E+12	*4.479E+12	*4.479E+12	*4.479E+12

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 4.352 ± 0.009 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
C-14	4.010E+02	4.352 ± 0.009	6.220E-02	4.020E+02	6.220E-02	4.020E+02

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW C-14.RAD

Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

Nuclide	Parent	THF(i)	DOSE(j,t), mrem/yr									
(j)	(i)		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	
C-14	C-14	1.000E+00	1.437E-02	1.294E-01	2.417E+01	2.042E-04	9.810E-25	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration

Parent Nuclide and Branch Fraction Indicated

Nuclide	Parent	THF(i)	S(j,t), pCi/g									
(j)	(i)		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	
C-14	C-14	1.000E+00	4.010E+02	3.948E+01	3.809E-01	3.207E-08	1.310E-28	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 59.81 seconds

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Dose Conversion Factor (and Related) Parameter Summary

Dose Library: DCFPAK3.02 (Adult)

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1 DCF's for external ground radiation, (mrem/yr)/(pCi/g)				
A-1	H-3 (Source: DCFPAK3.02)	0.000E+00	0.000E+00	DCF1(1)
B-1 Dose conversion factors for inhalation, mrem/pCi:				
B-1	H-3	9.689E-07	9.689E-07	DCF2(1)
D-1 Dose conversion factors for ingestion, mrem/pCi:				
D-1	H-3	1.550E-07	1.550E-07	DCF3(1)
D-34 Food transfer factors:				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(1,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(1,3)
D-5 Bioaccumulation factors, fresh water, L/kg:				
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(1,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(1,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.200E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	6.000E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): H-3	7.230E+02	0.000E+00	---	SI(1)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	WI(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	V CZ
R013	Contaminated zone total porosity	4.200E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.000E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.040E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	4.300E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	3.700E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	5.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.600E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.150E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
AA					
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.750E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
3 3 3 3 3					
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.371E-01	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
3 3 3 3 3					
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
3 3 3 3 3					

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name

R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)

R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK

R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR

R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)

Summary : RESRAD Default Parameters

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name

R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM

C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSNI
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSNI
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5

STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)

R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

TITL	Number of graphical time points	32	---	---	NPTS

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Pathway	3	User Selection
1 -- external gamma	3	active
2 -- inhalation (w/o radon)	3	active
3 -- plant ingestion	3	suppressed
4 -- meat ingestion	3	suppressed
5 -- milk ingestion	3	suppressed
6 -- aquatic foods	3	suppressed
7 -- drinking water	3	active
8 -- soil ingestion	3	active
9 -- radon	3	suppressed
Find peak pathway doses	3	active

Summary : RESRAD Default Parameters

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Contaminated Zone Dimensions	Initial Soil Concentrations, pCi/g
AAAAAA	AAAAAA
Area: 4200.00 square meters	H-3 7.230E+02
Thickness: 3.00 meters	
Cover Depth: 0.00 meters	

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

AAAAAA

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.218E-01	2.301E-01	2.165E+01	2.158E-01	1.607E-09	0.000E+00	0.000E+00	0.000E+00
M(t):	1.687E-02	9.204E-03	8.660E-01	8.633E-03	6.429E-11	0.000E+00	0.000E+00	0.000E+00

Maximum TDOSE(t): 2.499E+01 mrem/yr at t = 4.353 ñ 0.009 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.353E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
H-3	0.000E+00	0.0000	7.282E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.059E-05	0.0000
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	0.000E+00	0.0000	7.282E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.059E-05	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.353E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA		AAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
H-3	2.498E+01	0.9997	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.499E+01	1.0000
iiiiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii	iiiiiiii	iiiiii
Total	2.498E+01	0.9997	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.499E+01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	4.212E-01	0.9985	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.122E-04	0.0015
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	4.212E-01	0.9985	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.122E-04	0.0015

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.218E-01	1.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.218E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	1.659E-01	0.7211	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.412E-04	0.0010
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	1.659E-01	0.7211	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.412E-04	0.0010

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA	AAAAAAAAA	AAAAAA
H-3	6.393E-02	0.2778	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.301E-01	1.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	6.393E-02	0.2778	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.301E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	2.573E-02	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.740E-05	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	2.573E-02	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.740E-05	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA
H-3	2.162E+01	0.9988	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.165E+01	1.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	2.162E+01	0.9988	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.165E+01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	3.742E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.439E-08	0.0000
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	0.000E+00	0.0000	3.742E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.439E-08	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	2.158E-01	0.9998	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.158E-01	1.0000
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	2.158E-01	0.9998	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.158E-01	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	2.702E-13	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.927E-16	0.0000
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	0.000E+00	0.0000	2.702E-13	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.927E-16	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	1.607E-09	0.9998	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.607E-09	1.0000
iiiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii	iiiiiii	iiiiii
Total	1.607E-09	0.9998	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.607E-09	1.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA	AAAAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAA	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA	AAAAAAAA	AAAAAA
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
iiiiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii	iiiiiiiiii	iiiiii
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)							
			0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
H-3	H-3	1.000E+00	5.834E-04	3.182E-04	2.995E-02	2.985E-04	2.223E-12	3.036E-41	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life 6 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
H-3	4.285E+04	7.856E+04	8.348E+02	8.375E+04	1.125E+13	*9.621E+15	*9.621E+15	*9.621E+15	

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 4.353 ± 0.009 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
H-3	7.230E+02	4.353 ± 0.009	3.456E-02	7.233E+02	3.456E-02	7.233E+02

Summary : RESRAD Default Parameters

File : C:\RESRAD_FAMILY\ONSITE\7.2\USERFILES\FMS SITE SPECIFIC DCGL IW H-3.RAD

Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

Nuclide	Parent	THF(i)	DOSE(j,t), mrem/yr									
(j)	(i)		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	
H-3	H-3	1.000E+00	4.218E-01	2.301E-01	2.165E+01	2.158E-01	1.607E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration

Parent Nuclide and Branch Fraction Indicated

Nuclide	Parent	THF(i)	S(j,t), pCi/g									
(j)	(i)		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	
H-3	H-3	1.000E+00	7.230E+02	2.849E+02	4.418E+01	6.431E-02	4.655E-10	5.730E-39	0.000E+00	0.000E+00	0.000E+00	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 37.77 seconds