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April 25, 2003

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Annual Radiological Environmental Operating Report

Gentlemen:

Attached is the Annual Radiological Environmental Operating Report for the period of January 1 through December 31, 2002. This report is submitted pursuant to the requirements of Waterford 3 Technical Specification Section 6.9.1.7.

If there are any questions please contact T.M. Manzella at (504) 739-6882.

This submittal does not contain commitments.

Very truly yours,

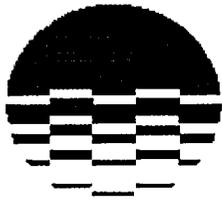

K.J. Peters 4/25/03
Director, Nuclear Safety Assurance

KJP/TMM/ssf
Attachment

IELS

Annual Radiological Environmental Operating Report
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Entergy

**Annual
Radiological Environmental Operating
Report**

January 1, 2002 - December 31, 2002



**Waterford 3 Steam Electric Station
Entergy Operations, Inc.**

Docket Number 50-382

License Number NPF-38

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Summary

The Annual Radiological Environmental Operating Report presents data obtained through analyses of environmental samples collected for Waterford 3's (W3) Radiological Environmental Monitoring Program (REMP) for the period January 1 through December 31, 2002. This report fulfills the requirements of W3 Technical Specification 6.9.1.7.

During 2002, gross beta radioactivity was detected in air and drinking water/surface water locations. Results obtained at the indicator locations were similar to those obtained at the control location. Therefore, levels continue to remain at background.

Cesium-137, a man-made nuclide, was detected once during 2002 at an indicator sediment location (SHWK-1). This is consistent with results obtained from the preoperational program and previous years of operation. Studies in Louisiana indicate that Cesium-137 is commonly found in soils and sediments as a result of atmospheric weapons testing. Because the Cesium-137 levels are consistent with preoperational values, the Cesium-137 level detected in 2002 is more than likely attributable to weapons testing fallout.

Tritium was detected in all samples at location GWK-1/SWK-1. Tritium is routinely released as measured in effluent sampling analysis via this pathway. Those levels observed are consistent with effluent sampling and analysis results.

Radiological Environmental Monitoring Program

W3 established the REMP prior to the station becoming operational (1985) to provide data on background radiation and radioactivity normally present in the area. W3 has continued to monitor the environment by sampling air, water, sediment, milk, fish and broadleaf vegetation, as well as measuring radiation directly.

The REMP includes sampling indicator and control locations within a 50-mile radius of the plant. The REMP utilizes indicator locations near the site to show any increases or buildup of radioactivity that might occur due to station operation, and control locations farther away from the site to indicate the presence of only naturally occurring radioactivity. W3 compares indicator results with control, preoperational, and previous years operational results to assess any impact W3 might have on the surrounding environment.

In 2002, W3 collected environmental samples for radiological analysis. Based on the comparison results of indicator locations with control locations and previous studies, it was concluded that overall W3 operations had no significant impact on plant environs with the exception of groundwater/surface water tritium where a direct correlation from plant operations exists well below the reporting level. The review of 2002 data, in many cases, showed undetectable radiation levels in the environment and near background level in significant pathways associated with W3.

Harmful Effects or Irreversible Damage

The REMP did not detect any harmful effects or evidence of irreversible damage in 2002. Therefore, no analysis or planned course of action to alleviate problems was necessary.

Reporting Levels

W3's review indicates that no samples equaled or exceeded reporting levels for radioactivity concentration in environmental samples, as outlined in Technical Requirements Manual (TRM) Table 3.12-2 when averaged over any calendar quarter, due to W3 effluents. Therefore, 2002 results did not trigger any Radiological Monitoring Program Special Reports.

Radioactivity Not Attributable to W3

The W3 REMP detected radioactivity attributable to other sources twice. These include the 25th Chinese nuclear test explosion in 1980, and the radioactivity plume release due to reactor core degradation at the Chernobyl Nuclear Power Plant in 1986.

Comparison to State Program

W3 compared REMP data to the monitoring program of the Environmental Radiological Laboratory – Department of Environmental Quality Laboratory Services Division (ERL-DEQLSD). The ERL-DEQLSD and the W3 REMP entail similar radiological environmental monitoring program requirements. Both programs have obtained similar results over previous years.

Sample Deviations**◆ Milk Samples**

Three milk samples were unavailable from indicator location MKQ-5 due to owner selling cows. Milk sample location MKQ-1 was removed from the program in March of 2002 in revision 7 of UNT-005-014 (ODCM). Milk samples from this location were not available during 2002 prior to removal from the program. One milk sample was unavailable from indicator location MKE-3 due to cows not producing enough milk. With the absence of milk samples at these locations, broadleaf vegetation sampling was performed as required by TRM Table 3.12-1.

◆ Air Samples

The air sample locations listed below failed to meet the requirement for sample continuity. As described in footnote (1) of TRM Table 3.12-1, deviations are permitted from the required sampling schedule due to malfunction of sampling equipment and other legitimate reasons.

Location	Sample period	Explanation of Deviation
APP-1	04/08/02 – 04/22/02	Loss of power, transformer replaced
APP-1	07/30/02 – 08/12/02	Crimp in flow meter tubing
APP-1	09/23/02 – 10/07/02	Sample pump tripped
APC-1	10/22/02 – 11/04/02	Sample pump tripped
APE-30	12/16/02 – 12/30/02	Circuit breaker trip

◆ Water Samples

The drinking/surface water sample location listed below failed to meet the requirement for sample continuity. However, required LLDs were achieved. As described in footnote (1) of TRM Table 3.12-1, deviations are permitted from the required sampling schedule due to malfunction of sampling equipment and other legitimate reasons.

Location	Sample period	Explanation of Deviation
SWK-1	07/15/02 – 08/12/02	Circuit breaker trip

◆ TLDs

First quarter TLDs for station E-5 had abnormal glow curves

◆ Missed Samples

TLDs located at station G-4 were missing at the time of the first quarter TLD exchange, TLDs located at stations H-8 and D-2 were missing at the time of the third quarter exchange.

◆ Required Lower Limit of Detection (LLD) Values

All LLDs during this reporting period were within the acceptable limits required by the W3 TRM.

◆ Unavailable Results

W3 received analytical results in adequate time for inclusion in this report. In addition, W3's review identified no missing results

Program Modifications

In February, 2002, REMP sample locations were cited using GPS coordinates and geological mapping software while revising the Offsite Dose Calculation Manual. As a result of this study, several discrepancies were noted with respect to sample locations including the following:

- TLD location R-1 was actually located in sector Q.
- TLD location H-6 was actually located in sector G.
- TLD location G-9 was actually located in sector F at a distance of 8 miles
- Air Sample location APG-1 was actually in sector F.
- Drinking/Surface water location DWG/SWG-2 was actually in sector F.

As a result of these discrepancies, the following changes were implemented in Revision 7 of the ODCM in March 2002.

- TLD location R-1 was moved a short distance to a location actually in sector R.
- TLD location H-6 was relocated to sector H eight miles from the plant because there was not a suitable location in sector H within the 6-8 km distance specified in Table 3.12-1 of the Technical Requirements Manual (TRM).
- TLD location G-9 was moved a short distance to a location actually in sector G, and the designation was changed to G-8.
- Air Sample location APG-1 was renamed to APF-1 and a verification of appropriate sector citing in accordance with the requirements of Table 3 12-1 of the TRM was performed.
- Drinking/Surface water location DWG/SWG-2 was renamed to DWF/SWF-2.

The following additional changes to the REMP were also incorporated in Revision 7 of the ODCM:

- Sample location descriptions were modified to include GPS coordinates, bearing, and distance.
- A control Shoreline Sediment sample (SHWQ-6) was added as a result of a requirement change to TRM Table 3.12-1 under DRN 02-357 which added an upstream requirement due to Entergy Nuclear - South REMP standardization.
- Shoreline Sediment frequency was changed from Semi-Annually to Annually as a result of a requirement change to TRM Table 3 12-1 under DRN 02-357 due to Entergy Nuclear - South REMP standardization.
- Broad Leaf and Milk collection frequency was changed from Monthly to Quarterly as a result of a requirement change to TRM Table 3.12-1 under DRN 02-357 due to Entergy Nuclear - South REMP standardization.
- Deleted Broad Leaf control location BLK-15 because this location was replaced with BLE-20 which meets the TRM Table 3.12-1 directional requirements and has been shown to provide sufficient vegetation throughout the year.
- Reclassified GWK-1 as Surface Water and installed a composite sampler at this location as required for surface water sampling. Ground Water sampling is no longer performed.
- Deleted Milk location MKQ-1 because this location no longer provides milk
- Added a new fish location, FH-3, because fish can conceivably be affected by plant discharges via the 40 Arpent Canal discharge pathway.

A copy of the affected ODCM Tables is included in this report in Attachment 3.

Attachments

Attachment 1 contains results of air, TLD, water, sediment, milk, fish and broadleaf vegetation collected in 2002. TLDs were analyzed by Waterford-3 Dosimetry. All remaining samples were analyzed by the River Bend (RBS) Environmental Laboratory. Attachment 1 also contains River Bend's participation in the interlaboratory comparison program during 2002.

Attachment 2 contains statistical comparisons of.

- TLD measurements from stations grouped by distance
- TLD radiation dose to historical data by location
- Gross beta activity measurements on air particulate filters
- Gross beta activity measurements in surface/drinking water samples

Attachment 3 contains 2002 revised ODCM tables

1.0 Introduction

1.1 Radiological Environmental Monitoring Program

W3 established the REMP to ensure that plant operating controls properly function to minimize any associated radiation endangerment to human health or the environment. The REMP is designed for.

- Analyzing important pathways for anticipated types and quantities of radionuclides released into the environment.
- Considering the possibility of a buildup of long-lived radionuclides in the environment and identifying physical and biological accumulations that may contribute to human exposures.
- Considering the potential radiation exposure to plant and animal life in the environment surrounding W3
- Correlating levels of radiation and radioactivity in the environment with radioactive releases from station operation.

1.2 Pathways Monitored

The airborne, direct radiation, waterborne and ingestion pathways are monitored as required by W3 TRM Table 3.12-1. A description of the W3 REMP utilized to monitor the exposure pathways is described in Table 1.1 and shown in Figures 1-1, 1-2 and 1-3.

Section 2.0 of this report provides a discussion of 2002 sampling results with Section 3.0 providing a summary of results for the monitored exposure pathways.

1.3 Land Use Census

W3 conducts a land use census biannually, as required by Section 3 12.2 of the TRM. The purpose of this census is to identify changes in uses of land within five miles of W3 that would require modifications to the REMP and the Offsite Dose Calculation Manual (ODCM). The most important criteria during this census are to determine the location in each sector of the nearest

- 1) Residence
- 2) Animal milked for human consumption
- 3) Garden of greater than 50 m² (500 ft²) producing broadleaf vegetation

W3 conducts the land use census by

- Field surveys in each meteorological sector out to five miles in order to confirm
 - Nearest permanent residence
 - Nearest garden and approximate size
 - Nearest beef cow
 - Nearest food product
 - Nearest milking animal.
- Identifying locations on maps, measuring distances to W3 and recording results on data sheets.
- Comparing current census results to previous results.

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Airborne	<p><u>Radioiodine and Particulates</u> Three samples from close to the three SITE BOUNDARY locations, in different sectors, in or near sectors having the highest calculated annual average ground level D/Q.</p>	<p>APQ-1 (NW, 0.81 Miles) – (West bank) Located in soybean/sugarcane field off LA 18 approximately 0.6 miles east of LA 18/3141 intersection.</p> <p>⁽¹⁾APG-1 (SE, 0.35 Miles) – (West bank) Located on north side of Secondary Meteorological Tower.</p> <p>APC-1 (NE, 0.67 Miles) – (East bank) Located inside the Little Gypsy Cooling Water Intake Structure fence enclosure.</p>	Continuous sampler operation with sample collection bi-weekly, or more frequently if required by dust loading.	<p>Radioiodine Canister – I-131 analysis bi-weekly.</p> <p>Particulate Sampler – Gross beta radioactivity analysis following filter change. Gamma isotopic analysis of composite (by location) quarterly.</p>
	<p><u>Radioiodine and Particulates</u> One sample from the vicinity of a community having the highest calculated annual average ground level D/Q.</p>	<p>APP-1 (WNW, 0.84 Miles) – (West bank) Located in soybean/sugarcane field at northwest corner of Short St. in Killona</p>		
	<p><u>Radioiodine and Particulates</u> One sample from a control location, as for example 15 -30 km distance and in the least prevalent wind direction.</p>	<p>APE-30 (E, 25.2 Miles) – (West bank) Located on the roof of the Entergy Office building on Delaronde St in Algiers. (Control)</p>		

(1) APG-1 changed to APF-1 effective 03-14-02 revision 7, UNT-005-014

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p>TLDs An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.</p>	<p>A-2 (N, 1.27 Miles) – (East bank) Located on a utility pole on LA 628 near the Zephrrn L. Perriloux Fire House.</p> <p>B-1 (NNE, 0.75 Miles) – (East bank) On fence enclosing the transmission tower 0.3 miles west (up-river) from Little Gypsy on LA 628.</p> <p>C-1 (NE, 0.67 Miles) – (East bank) On fence enclosing the Little Gypsy Cooling Water Intake on LA 628 near APC-1.</p> <p>D-2 (ENE, 1.24 Miles) – (East bank) Located approximately 0.3 miles east of Little Gypsy Power Station on stop sign post located at the peak of the levee on the west entrance road through the Bonnet Carre Spillway.</p>	Quarterly	Gamma dose quarterly.

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p>TLDs An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.</p>	<p>E-1 (E, 0.41 Miles) – (West bank) Located on utility pole along LA 18 approximately 0.3 miles east of Waterford 3 plant entrance.</p> <p>F-2 (ESE, 1.15 Miles) – (West bank) Located on southeast corner of fence enclosure surrounding the Entergy sub station 0.2 miles south of LA 18 on LA 3142.</p> <p>G-2 (SE, 1.26 Miles) – (West bank) Located on fence east of LA 3142 approximately 0.3 miles north of railroad overpass.</p> <p>H-2 (SSE, 1.54 Miles) – (West bank) Located off LA 3142 on southwest edge of fence along shell road 0.4 miles north of LA 3127/3142 intersection.</p>	Quarterly	Gamma dose quarterly.

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p>TLDs An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.</p>	<p>J-2 (S, 1.38 Miles) – (West bank) Located on fence enclosure for valve station south of LA 3127 approximately 0.6 miles west of LA 3127/3142 intersection.</p> <p>K-1 (SSW, 1.06 Miles) – (West bank) Located on stop sign at entrance to Entergy Education Center on LA 3127.</p> <p>L-1 (SW, 1.06 Miles) – (West bank) Located on gated entrance off of LA 3127 approximately 1.6 miles west of LA 3127/3142 intersection.</p> <p>M-1 (WSW, 0.76 Miles) – (West bank) Located on south gate of Waterford 1 and 2 fuel oil storage tank enclosure.</p> <p>N-1 (W, 0.98 Miles) – (West bank) Located on pole at corner of Railroad Avenue and School House Road.</p>	Quarterly	Gamma dose quarterly.

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p>TLDs An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY.</p>	<p>P-1 (WNW, 0.84 Miles) – (West bank) Located on fence enclosing air sample station APP-1.</p> <p>Q-1 (NW, 0.81 Miles) – ((West bank) Located on fence enclosing air sample station APQ-1.</p> <p>R-1 (NNW, 0.51 Miles) – (West bank) Located at Waterford 1 and 2 Cooling Water Intake Structure on east handrail approximately a quarter of the way down the catwalk.</p>	Quarterly	Gamma dose quarterly.
	<p>TLDs An outer ring of stations, 1 in 10 of the meteorological sectors in the 6- to 8-km range from the site.</p>	<p>A-5 (N, 4.59 Miles) – (East bank) Located on utility pole at intersection of Oswald Avenue and US 61.</p>		

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p>TLDs An outer ring of stations, 1 in 10 of the meteorological sectors in the 6- to 8-km range from the site.</p>	<p>B-4 (NNE, 3.75 Miles) – (East bank) Located on utility pole guidewire next to transmission tower south of weigh station on US 61 at St. John/St Charles Parish line</p> <p>D-5 (ENE, 4.09 Miles) – (East bank) Located on gate on shell road approximately 0.1 miles north of US61/LA48 intersection.</p> <p>F-4 (ESE, 3.53 Miles) – (West bank) Located on utility pole behind house at 646 Aquarius St. in Hahnville.</p>	Quarterly	Gamma dose quarterly.

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p>TLDs An outer ring of stations, 1 in 10 of the meteorological sectors in the 6- to 8-km range from the site</p>	<p>E-5 (E, 4.08 Miles) – (East bank) Located on the Norco Substation fence enclosure at the end of Wesco Street off of LA 48.</p> <p>G-4 (SE, 3.30 Miles) – (West bank) Located on railroad sign on LA 3160 approximately 0.1 miles north of railroad track.</p> <p>⁽²⁾H-8 (SSE, 8.13 Miles) – (West bank) Located on a road sign on south side of HWY 90 directly in front of Hahnville High School approximately 0.1 miles east of Tiger Drive.</p> <p>P-6 (WNW, 5.58 Miles) – (West bank) Located on a fence surrounding the communications tower at the LA 640/railroad track intersection.</p> <p>Q-5 (NW, 5.01 Miles) – (West bank) Located on utility pole along LA 18 across from Mississippi River marker 137.</p>	Quarterly	Gamma dose quarterly.

(2) H-6 changed to H-8 effective 03-14-02 revision 7, UNT-005-014

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p>TLDs An outer ring of stations, 1 in 10 of the meteorological sectors in the 6- to 8-km range from the site.</p>	<p>R-6 (NNW, 5.52 Miles) – (East bank) Located on fence enclosure approximately 0.2 miles west of US 61 on LA 3223 near railroad crossing.</p>	Quarterly	Gamma dose quarterly.
	<p>TLDs The balance of the stations to be in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations.</p>	<p>F-9 (ESE, 8.18 Miles) – (East bank) Located on entrance gate to Destrehan Substation just north of railroad tracks on Jonathan Street approximately 1.5 miles east of Luling-Destrehan Bridge, off of LA 48.</p> <p>⁽³⁾G-8 (SE, 7.74 Miles) – (West bank) Located on southern most corner of the back fence of Entergy Office in Luling.</p> <p>E-15 (E, 11.7 Miles) – (East bank) Located on Kenner Substation fence enclosure on Alliance Ave approximately 0.1 miles from LA 48.</p>		

(3) G-9 changed to G-8 effective 03-14-02 revision 7, UNT-005-014

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	<p><u>TLDs</u> The balance of the stations to be in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations.</p>	<p>J-15 (S, 11.7 Miles) - (West bank) Located on utility pole near the LA 631/Hwy 90 intersection in Des Allemands.</p> <p>E-30 (E, 25.2 Miles) - (West bank) Located at entrance to the Entergy Office on Delaronde St. in Algiers. (Control)</p>	Quarterly	Gamma dose quarterly.
Waterborne	<p><u>Surface Water</u> One sample upstream</p> <p>One sample downstream</p>	<p>SWP-7 (WNW, 7.37 Miles) - (West bank) Located at St. John Parish Waterworks off LA 18 in Edgard. (Control)</p> <p>⁽⁴⁾SWG-2 (SE, 1.51 Miles) - (West bank) Located at Dow Chemical Plant drinking water canal.</p> <p>SWE-5 (E, 4.59 Miles) - (East bank) Located at St. Charles Parish Waterworks off LA 48 in New Sarpy</p>	Composite sample over one quarter period.	Gamma isotopic analysis quarterly. Composite for tritium analysis quarterly.

(4) SWG-2 changed to SWF-2 effective 03-14-02 revision 7, UNT-005-014

**Table 1.1
Radiological Environmental Sampling Program**

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Waterborne	Drinking Water One sample upstream	DWP-7 (WNW, 7.37 Miles) - (West bank) Located at St John Parish Waterworks off LA 18 in Edgard. (Control)	Composite sample over one month period when I-131 analysis is performed, quarterly composite otherwise.	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than one mrem per year. Composite for gross beta and gamma isotopic analyses quarterly. Composite for tritium analysis quarterly.
	One sample downstream	⁽⁵⁾ DWG-2 (SE, 1.51 Miles) - (West bank) Located at Dow Chemical Plant drinking water canal. DWE-5 (E, 4.59 Miles) - (East bank) Located at St. Charles Parish Waterworks off of LA 48 in New Sarpy.		
	Sediment from Shoreline One sample upstream	⁽⁶⁾ SHWQ-6 (NW, 5.99 Miles) – (East bank) Located of LA 628 approximately 0.1 miles east of Reserve ferry landing	Annually	Gamma isotopic analysis annually.
	One sample downstream	SHWE-3 (E, 2.99 Miles) – (West bank) Located at Foot Ferry landing off LA 18 in Taft SHWK-1 (SSW, 0.49 Miles) –(West bank) Located at 40 Arpent Canal south of plant The canal is northwest of the shell access road/railroad track intersection.		
Ingestion	Milk Samples from milking animals in the three locations within 5 km distance having the highest dose potential. If there are none, then, one sample from milking animals in each of the three areas between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per year.	⁽⁷⁾ MKE-3 (E, 2.4 Miles) - (West bank) Located at the Zerngue's house on LA 18 in Taft. ⁽⁸⁾ MKQ-5 (NW, 4.99 Miles) - (West bank) Located at the Webre's house on LA 18 across from Mississippi River marker 137.	Quarterly	Gamma isotopic and I-131 analysis quarterly.

(5) DWG-2 changed to DWF-2 effective 03-14-02 revision 7, UNT-005-014

(6) Added to the program effective 03-14-02 revision 7, UNT-005-014

(7) Added to the program in 3rd quarter of 2002 ODCM change is in the review process

(8) Removing from the program, owner sold cows. ODCM change is in the review process

Table 1.1
Radiological Environmental Sampling Program

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Ingestion	<p>Milk One sample from milking animals at a control location 15 – 30 km distant and in the least prevalent wind direction.</p>	<p>MKR-40 (NNW, 4070 Miles) – (East bank) Located at 24254 LA Highway 442, Holden. La (Control)</p>	<p>Quarterly</p>	<p>Gamma isotopic and I-131 analysis quarterly.</p>
	<p>Fish and Invertebrates One sample of each commercially and recreational important species in vicinity of plant discharge area.</p> <p>One sample of same species in area not influenced by plant discharge</p>	<p>FH-2 (Distance/Direction Not Applicable)– Downstream of the plant intake structure.</p> <p>⁽⁹⁾ FH-3 (Distance/Direction Not Applicable)– (Westbank) Waterways downstream of plant discharge directed to 40 Arpent Canal.</p> <p>FH-1 (Distance/Direction Not Applicable) – Upstream of the plant discharge structure. (Control)</p>	<p>Sample in season, or annually if they are not seasonal</p>	<p>Gamma isotopic analysis on edible portion.</p>
	<p>Broadleaf Samples of one to three different kinds of broadleaf vegetation grown nearest each of two different off-site locations of highest predicted annual average groundlevel D/Q if milk sampling is not performed.</p> <p>One sample of each of the similar broadleaf vegetation grown 15 – 30 km distant in the least prevalent wind direction if milk sampling is not performed.</p>	<p>BLQ-1 (NW, 0.83 Miles) – (West bank) Located near air sample station APQ-1</p> <p>BLB-1 (NNE, 0.81 Miles) – (East bank) Located near transmission tower west of Little Gypsy on LA 628.</p> <p>⁽¹⁰⁾ BLK-15 (SSW, 15.0 Miles) – (West bank) Located 3 5 miles SSW of Des Allemands on Hwy. 90. (Control)</p> <p>BLE-20 (E, 19.7 Miles) – (West bank) Located on property of Nine Mile Point in Westwego, LA (Control)</p>	<p>Quarterly</p>	<p>Gamma isotopic and I-131 analysis.</p>

(9) Added to the program effective 03-14-02 revision 7, UNT-005-014

(10) Removed from the program effective 03-14-02 revision 7, UNT-005-014

FIGURE 1-1

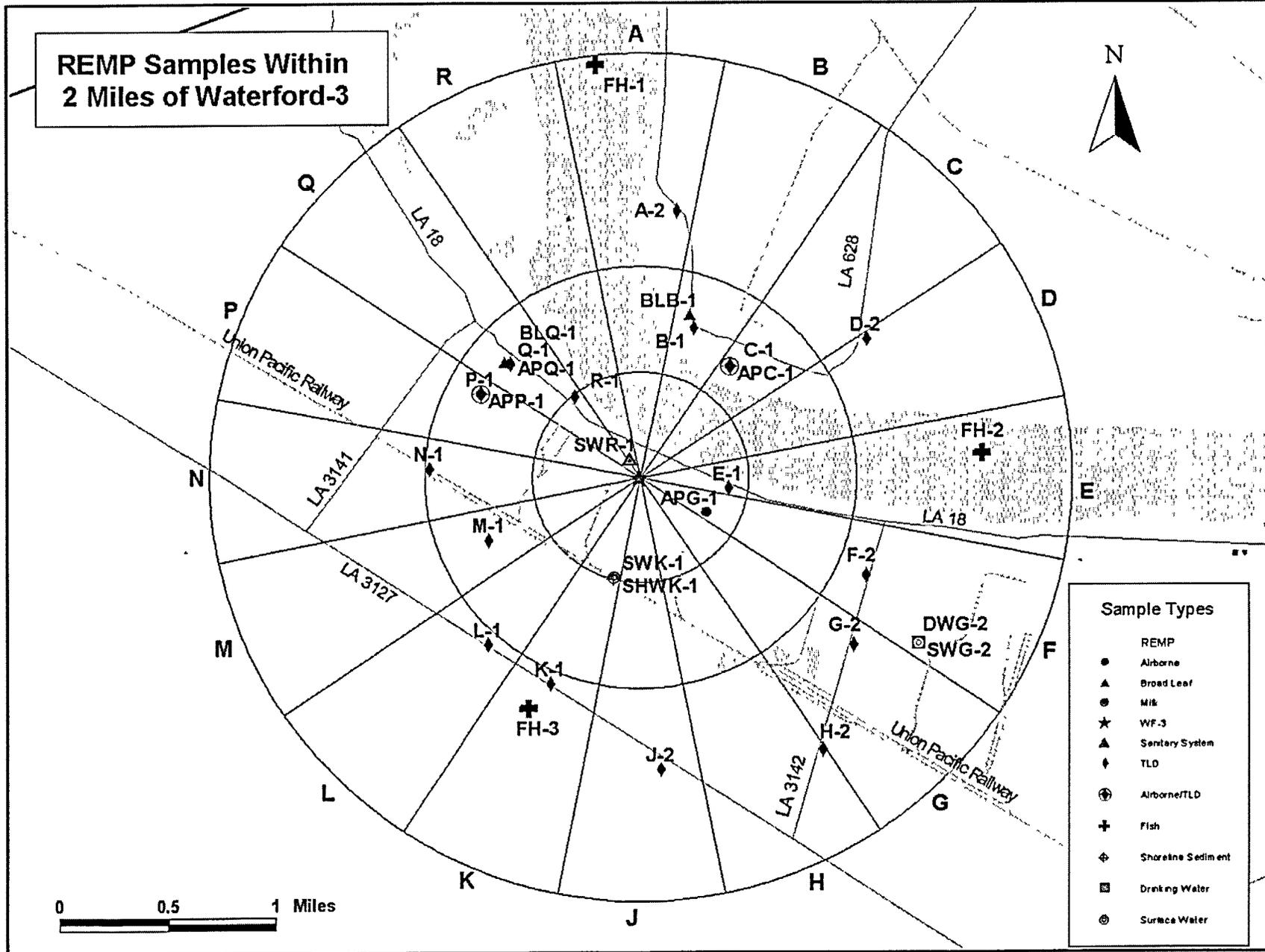


FIGURE 1-2

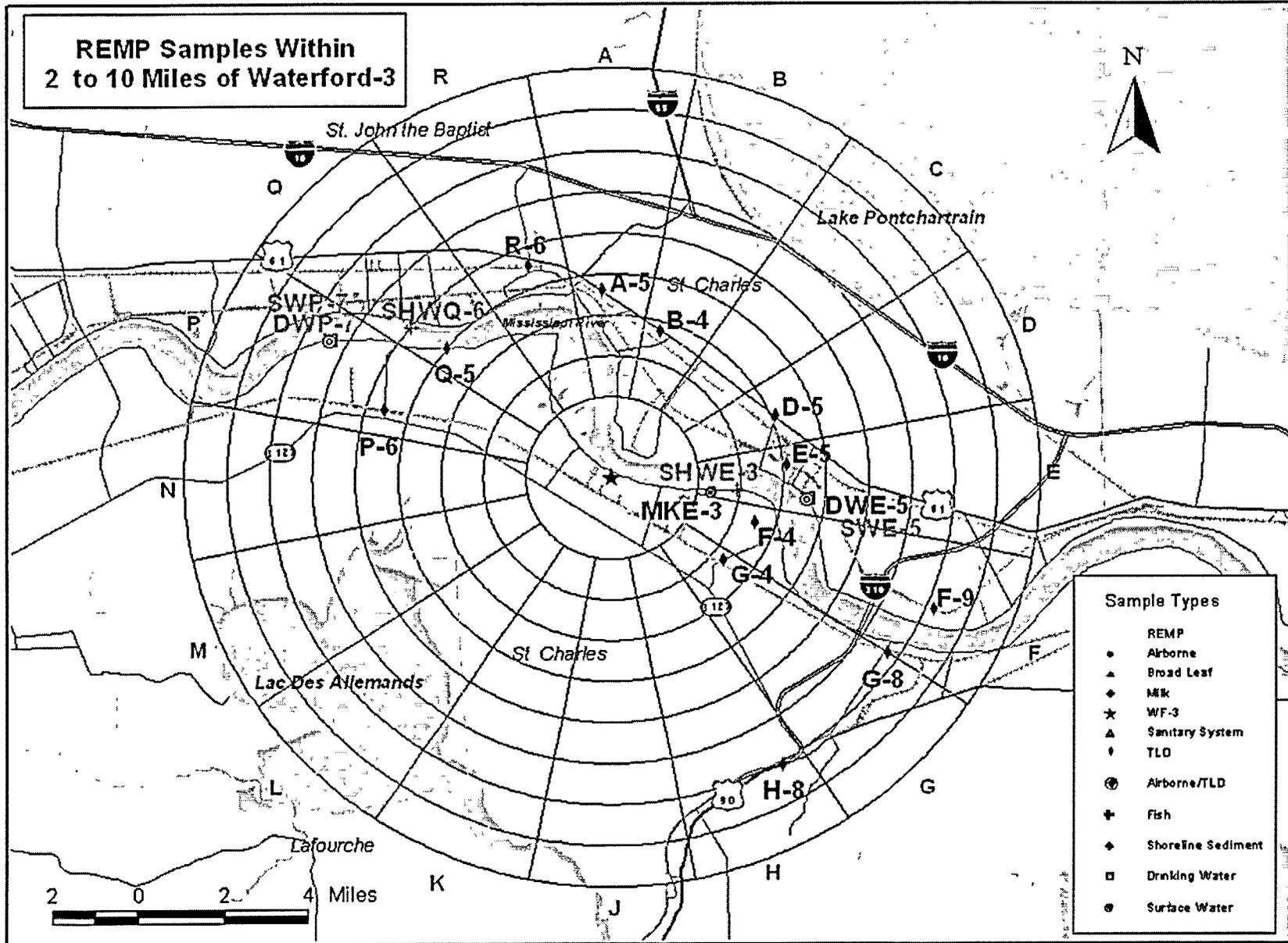
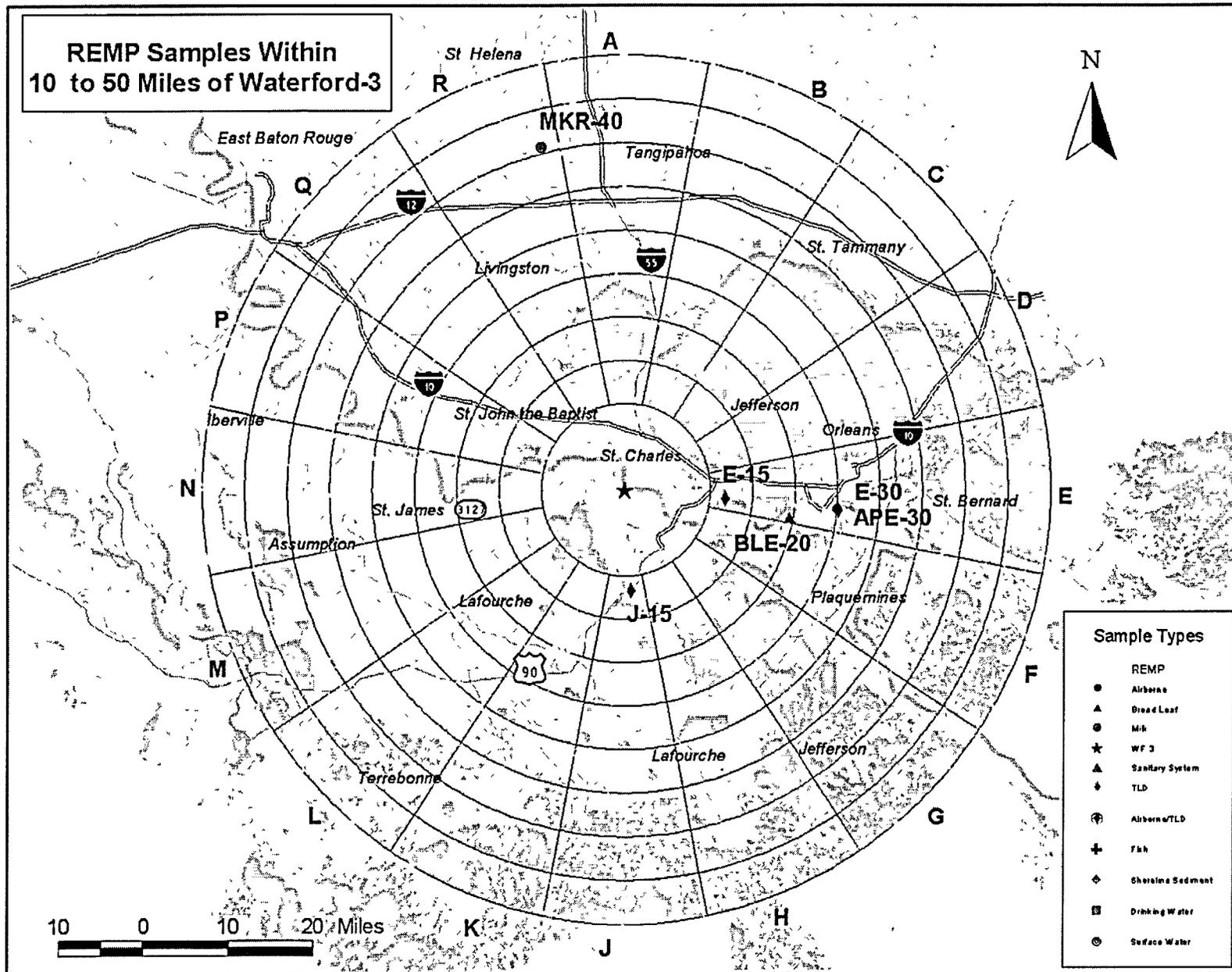


FIGURE 1-3



2.0 Interpretation and Trends of Results

2.1 Air Particulate and Radioiodine Sample Results

Samples of airborne particulate and radioiodine were collected at four indicator locations and one control location and analyzed for gross beta radionuclides, Iodine-131 and gamma radionuclides (quarterly air particulate filter composites only). W3 did not detect any gamma radionuclides in the quarterly air particulate composites or Iodine-131 in the radioiodine cartridges during the reporting period, as has been the case in previous years. Indicator gross beta air particulate results for 2002 were similar to those background levels obtained in previous years of the operational REMP and well below preoperational levels as seen below. Results are reported as annual average pCi/m^3 .

<u>Monitoring Period</u>	<u>Result</u>
Preoperational	0.080
1983 – 2001	0.019
2002	0.020

Table 3.1, which includes gross beta concentrations for 2002, provides a comparison of the indicator and control means, further emphasizes that the airborne pathway continues to remain at background levels. In addition, as shown in Attachment 2, the standard "t" test was used to compare average gross beta activity from each indicator station to the average gross beta activity at the control station. The results from this test show the average activity detected at all indicator stations is statistically the same as the average activity detected at the control station. Therefore, W3 concluded that plant operations had no significant impact on this pathway during 2002.

2.2 Thermoluminescent Dosimetry Sample Results

The average exposure rates during 2002 are consistent with those from the preoperational program and the previous five years of operation as seen in Figure 2-1. In particular, the preoperational survey indicates that exposure rates ranged between 11 and 33 mrem/standard quarter with an average of 20 mrem/standard quarter. The range during the previous five years of operation was 9 to 15 mrem/standard quarter with an average exposure rate of 12 mrem/standard quarter.

A comparison of the indicator results to the control results, as seen in Table 3.1, shows that the average indicator is slightly higher than that of the control. As shown in Attachment 1, Table 2.1, several indicator locations are higher than the control by a few mrem with a maximum difference of five mrem on one occasion (G-2, 4th Qtr).

As shown in Attachment 2, Table 2.1, the standard "t" test was used to compare average exposure rates for TLD stations located in groups 0-2 miles and 2-5 miles from the plant to those >5 miles. The results indicate that the average exposure rates 0-2 miles from the plant are statistically the same as >5 miles while those 2-5 miles are statistically higher.

The differences between indicator locations and the control, and TLD stations grouped by distance from the plant are expected due to a variety of factors not related to W3 plant operations that can affect background radiation in the vicinity of each TLD station. Direct radiation measurements at each TLD station have remained statistically the same in 2002 as previous years of operation as evidenced on Attachment 2, Table 2.2. In addition, Radiological Gaseous Effluents for 2002 were only a small fraction of the limits as is typical in previous years of operation and are not expected to have any impact on environmental TLD measurements.

2.3 Water Sample Results

Analytical results for 2002 drinking/surface water and groundwater samples were similar to those reported in previous years

Drinking/Surface Water

Drinking water samples also serve as surface water samples for W3. Therefore, monthly and quarterly gamma spectroscopy and tritium analyses of drinking water also satisfy the surface water sampling requirement

Composite drinking/surface water samples were collected from two indicator and one control location and analyzed for Iodine-131, gamma radionuclides and tritium. Results indicate that all measurements were below the calculated LLDs.

Although gross beta was detected in the drinking/surface water samples, results for the indicator locations were below previous operational and preoperational years as seen below. Results are reported as annual average pCi/l.

<u>Monitoring Period</u>	<u>Result</u>
Preoperational	7.0
1983 – 2001	5.3
2002	2.9

Table 3 1, which includes gross beta concentrations for 2002, provides a comparison of the indicator and control means, shows that the waterborne pathway continues to remain at background levels. In addition, as shown in Attachment 2, the standard "t" test was used to compare average gross beta activity from each indicator station to the average gross beta activity from the control station. The results from this test show average activity detected at all indicator stations is statistically the same as the average activity detected at the control station. Therefore, W3 concluded that plant operations had no significant impact on this pathway during 2002.

Groundwater

Groundwater samples were collected from one indicator location and analyzed for gamma radionuclides and tritium. W3 did not detect any gamma radionuclides in groundwater samples during the reporting period.

Tritium concentrations detected in 2002 are higher than those from the preoperational program as seen below. Results are reported as annual average pCi/l.

<u>Monitoring Period</u>	<u>Result</u>
Preoperational	121
1983 – 2001	895
2002	2746

Tritium is expected due to liquid effluent releases from the Turbine Building Industrial Waste Sump (TBIWS) normally being directed to the 40 Arpent canal where samples are collected. Dry Cooling Tower Sumps (DCTs) were aligned to Circ Water for all of 2002. Water from these pathways is typically discharged at a rate of approximately 20,000 gallons per day total with tritium concentration ranging from 1.07E-6 uCi/ml to 1.61E-4 uCi/ml. The plant effluent is diluted by adjoining canals and rain, which can vary significantly depending on weather conditions, prior to reaching the sample location. As a result, samples collected after periods of heavy rain can indicate concentrations below detection levels, while those collected during dry periods have the potential to approach concentrations discharged directly from the plant via the TBIWS.

Minor primary to secondary leakage has resulted in a rising trend in TBIWS tritium levels. This was identified in the 4th quarter of 2002. Actions were taken to address the rise to prevent the approach of the reporting limit for SWK-1.

As of March 14, 2002, the groundwater sample location was reclassified as Surface Water which requires the use of a continuous composite sampler. This sampling methodology should provide a better representation of the actual concentration of tritium at this location with less variability in sample results due to short-term changes in weather conditions.

2.4 Sediment Sample Results

Sediment samples were collected from two indicator locations and one control location and analyzed for gamma radionuclides. Cesium-137, a man-made nuclide, was detected in one sample (SHWK-1) with a concentration of 69 pCi/kg. No other man-made radionuclides were detected in any of the samples.

The Cesium-137 results obtained during 2002 are consistent with those from the preoperational program and previous years of operation. In particular, the preoperational survey indicates that Cesium-137 was detected in 9 of 14 soil samples at concentrations ranging between 30 and 890 pCi/kg with an average concentration of 164 pCi/kg. Similarly, the range indicated during the previous years of operation was 18 to 142 pCi/kg with an average activity of 56 pCi/kg.

W3 has detected Cs-137 in wastewater tanks discharged to the Mississippi River at concentrations typically below 1E-6 uCi/ml in the past few years. After dilution by Circulating Water, this concentration is reduced to well below 1E-10 uCi/ml prior to mixing with the Mississippi River where it is diluted even further. At the minimal concentrations being discharged from W3 as compared to the typical Cs-137 concentrations commonly found in soils and sediments in Louisiana as a result of atmospheric fallout from nuclear weapons testing as noted in the preoperational study, plant operations is not expected to result in any appreciable quantities of radioactivity in sediment collected from the bank of the Mississippi River where SHWE-3 is located. In addition, the radioactivity detected in sediment this year is consistent with preoperational data even after applying a correction for natural decay of Cs-137.

Therefore, W3 concluded that plant operations had no significant impact on this pathway during 2002.

2.5 Milk Sample Results

Milk samples were collected from one indicator and one control location and analyzed for Iodine-131 and gamma radionuclides. Results indicate that all measurements were below the calculated LLDs. Therefore, W3 concluded that plant operations had no significant impact on this pathway during 2002.

2.6 Fish Sample Results

Fish samples were collected from two indicator and one control location and analyzed for gamma radionuclides. Results indicate that all measurements were below the calculated LLDs. Therefore, W3 concluded that plant operations had no significant impact on this pathway during 2002.

2.7 Broadleaf Vegetation Sample Results

Broadleaf vegetation samples were collected from two indicator and two control locations and analyzed for Iodine-131 and gamma radionuclides. Control location BLK-15 was removed from the program effective March 14, 2002 in revision 7 of UNT-005-014 (ODCM). Results indicate that all measurements were below the calculated LLDs. Therefore, W3 concluded that plant operations had no significant impact on this pathway during 2002.

2.8 Land Use Census Results

In compliance with the Waterford 3 ODCM and TRM, the land use census was conducted on September 24, September 30 and October 8, 2002. The nearest residence, garden, beef cow, food product and milk animal in each sector within a five mile radius of the plant was located by visual inspection and verbal inquiry.

While garden and food product locations remained unchanged for 2002, one location of goats (sector E) and one location of milk cows (sector Q) were removed. One new resident location (sector Q), one new milk cow location (sector E) and one new beef cow location (sector E) was identified in 2002. Based upon the locations identified in this survey, the locations identified in previous surveys and the locations currently being used to calculate dose commitments from liquid and gaseous effluents released from W3, no REMP sampling location changes are necessary. Results of the 2002 biannual census are shown in Table 2.1.

2.9 Interlaboratory Comparison Results

The River Bend Station Environmental Laboratory analyzed interlaboratory comparison samples for W3 to fulfill the requirements of Section 5.7.2 of the ODCM. Attachment 1 contains these results. For the sample result outside the acceptable control limit, W3 and RBS's review indicated no impact on previously reported data. Attachment 1 also provides additional discussion regarding the sample result outside the acceptable control limit.

TABLE 2.1
Biannual Land Use Census Results

Sector	Direction	Distance from Plant in Miles					
		Residence	Garden	Milk Cows	Beef Cows	Goats	Food Products
A	N	1.3	1.7	* 4.6	4.6	^	4.1
B	NNE	1.1	1.3	^	^	^	1.3
C	NE	0.9	0.9	^	^	^	^
D	ENE	0.9	0.9	^	^	^	^
E	E	2.2	2.2	**2.3	2.3	* 2.3	0.3
F	ESE	3.1	2.2	^	2.3	^	0.3
G	SE	4.0	4.1	^	2.4	^	0.3
H	SSE	^	^	^	^	^	0.3
J	S	^	^	^	^	^	0.5
K	SSW	^	^	^	^	^	0.5
L	SW	^	^	^	^	^	0.5
M	WSW	^	1.4	^	1.2	^	0.5
N	W	1.0	1.1	^	1.0	^	0.6
P	WNW	0.9	0.9	^	0.9	^	0.6
Q	NW	0.7***	1.0	^	0.9	^	0.6
R	NNW	3.0	3.0	^	4.9	^	2.6

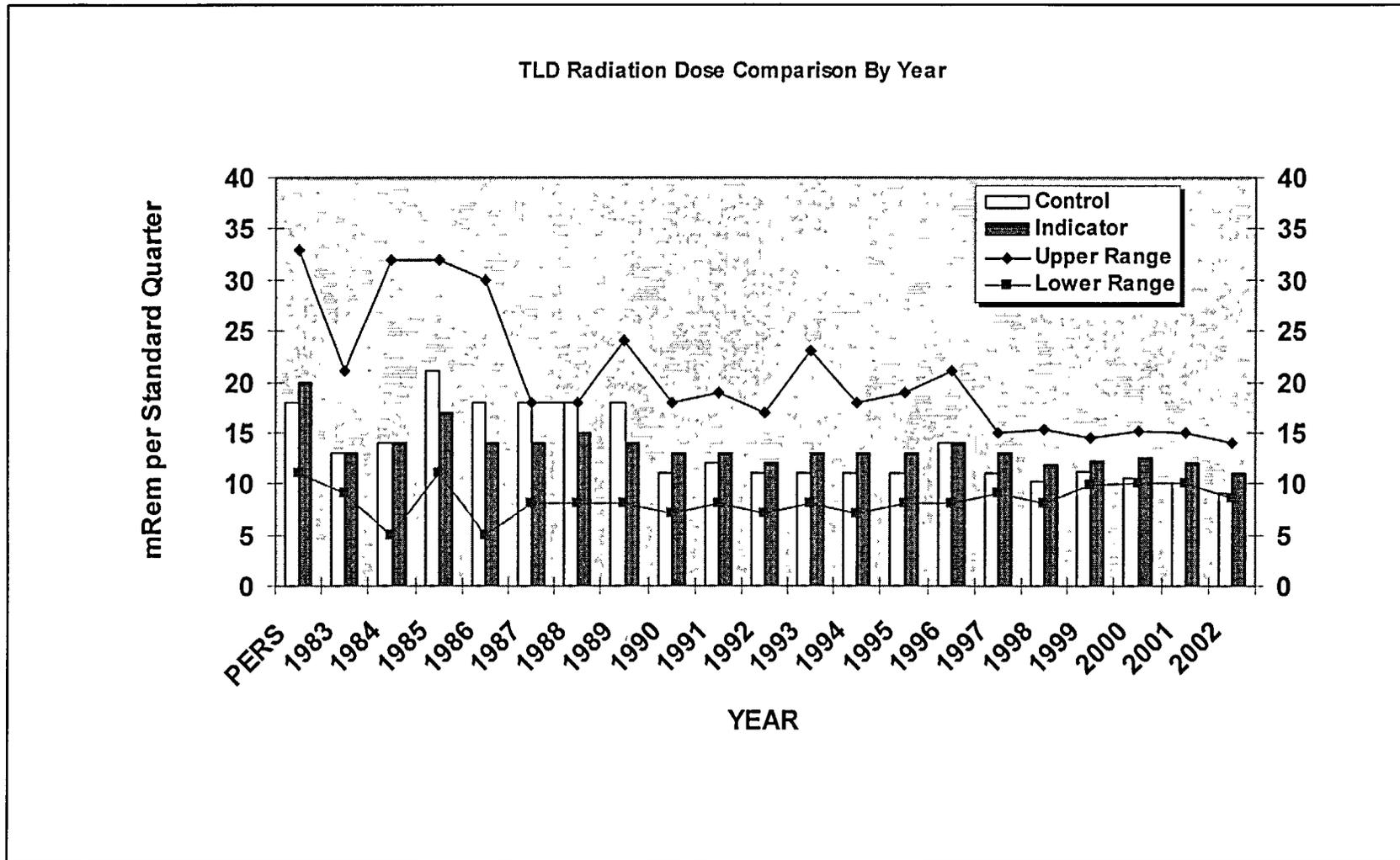
^ Indicates that nothing was found in the Sector within a five mile radius of Waterford 3

* Animals were located at this distance from Waterford 3, but the milk is not currently used for human consumption

** Samples are being obtained from animals at this location (MKE-3) for REMP

*** Residence distance 0.9 miles vs 0.7 miles as per G. Hood's review dated 04-16-03

FIGURE 2-1
TLD RADIATION DOSE COMPARISON (BY YEAR)



3.0 Radiological Environmental Monitoring Program Summary

3.1 2002 Program Results Summary

Table 3.1 summarizes the 2002 REMP results. W3 did not use values reported as less than the lower limit of detection (<LLD) when determining ranges and means for indicator and control locations.

TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: **Waterford 3 SES** Docket No: **50-382**
Location of Facility: **St. Charles, Louisiana** Reporting Period: **January - December 2002**

Sample Type (Units)	Type & Number Of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Airborne Particulates (pCi/m ³)	GB 128	0.01	0.019 (102 / 104) [0.008 - 0.034]	APF-1 (ESE, 0.35 mi)	0.018 (26 / 26) [0.008 - 0.034]	0.019 (26 / 26) [0.009 - 0.034]	0
	GS 20						
	Cs-134 Cs-137	0.05 0.06	<LLD <LLD	N/A N/A	N/A N/A	<LLD <LLD	0 0
Airborne Iodine (pCi/m ³)	I-131 128	0.07	<LLD	N/A	N/A	<LLD	0
Indicator TLDs (mrem/Std. Qtr)	Gamma 116	(f)	11.1 (116 / 120) [8.6 - 14.0]	G-2 (SE, 1.26 mi.)	14.0 (4 / 4) [13.3 - 15.3]	N/A	0
Control TLDs (mrem/Std. Qtr)	Gamma 4	(f)	N/A	N/A	N/A	9.3 (4 / 4) [8.9 - 9.8]	0

TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: **Waterford 3 SES** Docket No: **50-382**
Location of Facility: **St. Charles, Louisiana** Reporting Period: **January - December 2002**

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Location Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Surface Water & Drinking Water (pCi/l)	Gross Beta 12	4	2.9 (8 / 8) [1.4 – 6.0]	DWE-5 (E, 4.59 mi.)	3.5 (4 / 4) [1.4 – 6.0]	2.8 (4 / 4) [1.3 – 4.1]	0
	I-131 42	1	<LLD	N/A	N/A	<LLD	0
	*H-3 15	2000	3697 (11/11) [2297 – 4670]	SWK-1 (SSW, 0.49 mi)	3697 (3/3) [2297 – 4670]	<LLD	0
	GS 15						
	Mn-54 15		<LLD	N/A	N/A	<LLD	0
	Fe-59 30		<LLD	N/A	N/A	<LLD	0
	Co-58 15		<LLD	N/A	N/A	<LLD	0
	Co-60 15		<LLD	N/A	N/A	<LLD	0
	Zn-65 30		<LLD	N/A	N/A	<LLD	0
	Zr-95 30		<LLD	N/A	N/A	<LLD	0
	Nb-95 15		<LLD	N/A	N/A	<LLD	0
	Cs-134 15		<LLD	N/A	N/A	<LLD	0
	Cs-137 18		<LLD	N/A	N/A	<LLD	0
	Ba-140 60		<LLD	N/A	N/A	<LLD	0
La-140 15		<LLD	N/A	N/A	<LLD	0	

* GWK-1 changed to SWK-1 effective 03-14-02 in revision 7 of UNT-005-014

TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: Waterford 3 SES Docket No: 50-382
Location of Facility: St. Charles, Louisiana Reporting Period: January - December 2002

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Groundwater (pCi/l)	H-3 2	2000	1320 (2/2) [1190 - 1449]	GWK-1 [SSW, 0.49 mi.]	1320 (2/2) [1190 - 1449]	N/A	0
	GS 2						
	Mn-54	15	<LLD	N/A	N/A	N/A	0
	Fe-59	30	<LLD	N/A	N/A	N/A	0
	Co-58	15	<LLD	N/A	N/A	N/A	0
	Co-60	15	<LLD	N/A	N/A	N/A	0
	Zn-65	30	<LLD	N/A	N/A	N/A	0
	Zr-95	30	<LLD	N/A	N/A	N/A	0
	Nb-95	15	<LLD	N/A	N/A	N/A	0
	Cs-134	15	<LLD	N/A	N/A	N/A	0
	Cs-137	18	<LLD	N/A	N/A	N/A	0
	Ba-140	60	<LLD	N/A	N/A	N/A	0
La-140	15	<LLD	N/A	N/A	N/A	0	
Shoreline Sediment (pCi/kg dry)	GS 3						
	Cs-134	150	<LLD	N/A	N/A	N/A	0
	Cs-137	180	69.3 (1/3) [N/A]	SHWK-1 [SSW, 0.49 mi]	69.3 (1/3) [N/A]	N/A	0

TABLE 3.1

Radiological Environmental Monitoring Program Summary

Name of Facility: **Waterford 3 SES** Docket No: **50-382**
Location of Facility: **St. Charles, Louisiana** Reporting Period: **January - December 2002**

Sample Type (Units)	Type & Number of Analyses ^a	LLD ^b	Indicator Location Mean (F) ^c [Range]	Location with Highest Annual Mean		Control Locations Mean (F) ^c [Range]	Number of Nonroutine Results ^e
				Location ^d	Mean (F) ^c [Range]		
Milk (pCi/l)	I-131 14	1	<LLD	N/A	N/A	<LLD	0
	GS 14						
	Cs-134 15		<LLD	N/A	N/A	<LLD	0
	Cs-137 18		<LLD	N/A	N/A	<LLD	0
	Ba-140 60		<LLD	N/A	N/A	<LLD	0
	La-140 15		<LLD	N/A	N/A	<LLD	0
Fish (pCi/kg wet)	GS 12						
	Mn-54 130		<LLD	N/A	N/A	<LLD	0
	Fe-59 260		<LLD	N/A	N/A	<LLD	0
	Co-58 130		<LLD	N/A	N/A	<LLD	0
	Co-60 130		<LLD	N/A	N/A	<LLD	0
	Zn-65 260		<LLD	N/A	N/A	<LLD	0
	Cs-134 130		<LLD	N/A	N/A	<LLD	0
	Cs-137 150		<LLD	N/A	N/A	<LLD	0
Broadleaf Vegetation (pCi/kg wet)	I-131 21	60	<LLD	N/A	N/A	<LLD	0
	GS 21						
	Cs-134 60		<LLD	N/A	N/A	<LLD	0
	Cs-137 80		<LLD	N/A	N/A	<LLD	0

^a GB = Gross beta; I-131 = Iodine-131; H-3 = Tritium; GS = Gamma scan.

^b LLD = Required lower limit of detection based on Waterford 3 TRM.

^c Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parenthesis (F).

^d Locations are specified (1) by name and (2) degrees relative to reactor site.

^e Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.

^f LLD is not defined in Waterford 3 TRM.

Attachment 1
2002 Radiological Monitoring Report
Summary of Monitoring Results

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Table 1.1
Sample Type: Air Particulate Filter
Analysis: Gross Beta
Units: pCi/m³

Start Date	End Date	***APG-1 (Indicator)	APQ-1 (Indicator)	APP-1 (Indicator)	APC-1 (Indicator)	APE-30 (Control)
	<u>Required LLD</u>	→ <u>0.01</u>	<u>0.01</u>	<u>0.01</u>	<u>0.01</u>	<u>0.01</u>
12-31-2001	01-14-2002	0.0268	0.0261	0.0258	0.0248	0.0268
01-14-2002	01-28-2002	0.0255	0.0292	0.0259	0.0257	0.0257
01-28-2002	02-11-2002	0.0206	0.0230	0.0228	0.0198	0.0209
02-11-2002	02-25-2002	0.0166	0.0168	0.0169	0.0172	0.0168
02-25-2002	03-11-2002	0.0224	0.0215	0.0247	0.0235	0.0217
03-11-2002	03-25-2002	0.0245	0.0249	0.0254	0.0221	0.0240
03-25-2002	04-08-2002	0.0177	0.0194	0.0174	0.0162	0.0180
04-08-2002	04-22-2002	0.0195	0.0196	0.0199	0.0203	0.0192
04-22-2002	05-06-2002	0.0128	0.0124	*	0.0115	0.0129
05-06-2002	05-20-2002	0.0173	0.0172	0.0170	0.0164	0.0173
05-20-2002	06-03-2002	0.0119	0.0111	0.0106	0.0111	0.0108
06-03-2002	06-17-2002	0.0170	0.0185	0.0176	0.0154	0.0161
06-17-2002	07-01-2002	0.0153	0.0161	0.0158	0.0147	0.0157
07-01-2002	07-15-2002	0.0129	0.0144	0.0143	0.0135	0.0132
07-15-2002	07-30-2002	0.0124	0.0091	0.0121	0.0130	0.0124
07-30-2002	08-12-2002	0.0134	0.0160	0.0140	0.0136	0.0131
08-12-2002	08-26-2002	0.0153	0.0154	0.0154	0.0160	0.0157
08-26-2002	09-09-2002	0.0075	0.0095	0.0096	0.0077	0.0086
09-09-2002	09-23-2002	0.0153	0.0168	0.0150	0.0161	0.0164
09-23-2002	10-07-2002	0.0209	0.0211	0.0208	0.0200	0.0206
10-07-2002	10-22-2002	0.0108	0.0102	**	0.0110	0.0102
10-22-2002	11-04-2002	0.0225	0.0230	0.0247	0.0221	0.0249
11-04-2002	11-18-2002	0.0165	0.0184	0.0162	0.0144	0.0177
11-18-2002	12-03-2002	0.0340	0.0337	0.0317	0.0329	0.0339
12-03-2002	12-16-2002	0.0213	0.0232	0.0213	0.0217	0.0232
12-16-2002	12-30-2002	0.0280	0.0270	0.0267	0.0295	0.0319

* Loss of power; transformer replaced
 ** Sample pump tripped
 *** APG-1 changed to APF-1 effective 03-14-02, revision 7, UNT-005-014

Table 1.2

Sample Type Radioiodine Cartridge

Analysis: Iodine-131

Units: pCi/m³

Start Date	End Date	***APG-1 (Indicator)	APQ-1 (Indicator)	APP-1 (Indicator)	APC-1 (Indicator)	APE-30 (Control)
	<u>Required LLD</u>	→ <u>0.07</u>	<u>0.07</u>	<u>0.07</u>	<u>0.07</u>	<u>0.07</u>
12-31-2001	01-14-2002	<0.0155	<0 0155	<0.0184	<0 0123	<0.0167
01-14-2002	01-28-2002	<0 0138	<0 0143	<0.0148	<0.0113	<0.0154
01-28-2002	02-11-2002	<0 0134	<0 0136	<0 0134	<0.0104	<0.0148
02-11-2002	02-25-2002	<0.0102	<0 0145	<0.0143	<0 0137	<0 0182
02-25-2002	03-11-2002	<0.0127	<0 0130	<0.0141	<0.0159	<0.0130
03-11-2002	03-25-2002	<0.0151	<0 0153	<0.0199	<0 0149	<0.0164
03-25-2002	04-08-2002	<0.0128	<0 0117	<0.0132	<0 0127	<0.0141
04-08-2002	04-22-2002	<0.0142	<0 0160	<0.0167	<0 0140	<0.0130
04-22-2002	05-06-2002	<0 0178	<0.0142	*	<0 0130	<0.0148
05-06-2002	05-20-2002	<0.0136	<0.0135	<0 0150	<0 0142	<0.0137
05-20-2002	06-03-2002	<0.0142	<0.0131	<0 0161	<0 0151	<0.0153
06-03-2002	06-17-2002	<0.0143	<0 0142	<0 0186	<0.0187	<0.0113
06-17-2002	07-01-2002	<0.0141	<0 0129	<0 0163	<0.0138	<0.0115
07-01-2002	07-15-2002	<0.0147	<0.0138	<0.0139	<0.0139	<0.0167
07-15-2002	07-30-2002	<0.0121	<0 0135	<0.0145	<0.0119	<0.0132
07-30-2002	08-12-2002	<0.0152	<0.0188	<0 0162	<0.0154	<0.0116
08-12-2002	08-26-2002	<0.0134	<0 0127	<0.0603	<0.0207	<0.0171
08-26-2002	09-09-2002	<0.0122	<0.0143	<0 0153	<0.0129	<0.0140
09-09-2002	09-23-2002	<0.0150	<0.0133	<0 0129	<0.0174	<0.0145
09-23-2002	10-07-2002	<0 0156	<0 0131	<0.0166	<0.0146	<0.0129
10-07-2002	10-22-2002	<0 0139	<0.0132	**	<0.0161	<0.0118
10-22-2002	11-04-2002	<0 0174	<0.0207	<0.0178	<0 00163	<0 0198
11-04-2002	11-18-2002	<0.0117	<0.0162	<0.0152	<0.0141	<0 0125
11-18-2002	12-03-2002	<0.0141	<0.0153	<0.0189	<0.0140	<0 0178
12-03-2002	12-16-2002	<0 0125	<0.0141	<0 0143	<0 0111	<0 0129
12-16-2002	12-30-2002	<0 0158	<0.0161	<0.0150	<0.0129	<0 0123

* Loss of power; transformer replaced

** Sample pump tripped

*** APG-1 changed to APF-1 effective 03-14-02, revision 7, UNT-005-014

Table 1.3
Sample Type Air Particulate Filter
Analysis: Gamma Isotopic
Units: pCi/m³

Location	Quarterly Composite		Cs-134	Cs-137
	<u>Required LLD</u>	→	<u>0.05</u>	<u>0.06</u>
*APG-1	1st		<0 00221	<0 00198
APQ-1	1st		<0 00182	<0 00217
APP-1	1st		<0 00225	<0.00179
APC-1	1st		<0 00219	<0 00233
APE-30	1st		<0 00248	<0 00203
*APG-1	2nd		<0 00262	<0 00252
APQ-1	2nd		<0 00203	<0.00265
APP-1	2nd		<0 00187	<0 00250
APC-1	2nd		<0.00211	<0 00183
APE-30	2nd		<0.00227	<0 00175
*APG-1	3rd		<0 00195	<0 00122
APQ-1	3rd		<0 00244	<0 00226
APP-1	3rd		<0 00208	<0 00218
APC-1	3rd		<0 00143	<0 00122
APE-30	3rd		<0 00134	<0 00147
*APG-1	4th		<0 00166	<0 00176
APQ-1	4th		<0 00191	<0 00161
APP-1	4th		<0 00198	<0.00171
APC-1	4th		<0 00167	<0 00121
APE-30	4th		<0 00152	<0 00229

* APG-1 changed to APF-1 effective 03-14-02, revision 7, UNT-005-014

Table 2.1

Sample Type: Thermoluminescent Dosimeters

Analysis: Gamma Dose

Units: mrem/Std Qtr.

Indicator Locations					
Station	1st Qtr '02	2nd Qtr '02	3rd Qtr '02	4th Qtr '02	Annual Mean '02
A-2	12	11	12	13	12
A-5	11	11	10	11	11
B-1	11	11	11	12	11
B-4	12	13	12	13	12
C-1	9	9	8	9	9
D-2	11	12	***	13	12
D-5	10	10	10	12	11
E-1	10	10	10	11	10
E-5	**	10	11	11	11
E-15	9	8	9	10	9
F-2	11	11	10	12	11
F-4	13	13	12	14	13
F-9	11	11	11	13	12
*G-2	13	14	13	15	14
G-4	***	10	9	11	10
G-9	10	9	9	10	9
H-2	11	11	11	13	12
H-6	11	11	***	13	12
J-2	11	11	12	12	12
J-15	11	13	12	13	12
K-1	11	10	11	12	11
L-1	12	11	12	12	12
M-1	10	10	13	11	11
N-1	12	11	13	13	12
P-1	9	9	9	9	9
P-6	12	12	15	13	13
Q-1	11	11	12	11	11
Q-5	11	10	11	11	11
R-1	8	.6	10	10	9
R-6	9	9	10	10	9
Station	1st Qtr '02	Control Location 2nd Qtr '02	3rd Qtr '02	4th Qtr '02	Annual Mean '02
E-30	9	9	9	10	9

* Location with highest annual mean.

** TLDs located at E-5 had abnormal glow curves.

*** TLDs located at G-4 were missing at the time of the 1st quarter exchange. TLDs located at H-8 and D-2 were missing at the time of the 3rd quarter exchange.

Table 3 1
Sample Type. Drinking/Surface Water
Analysis: Gross Beta
Units: pCi/l

Quarterly Composite	*DWG/SWG-2 (Indicator)	DWE/SWE-5 (Indicator)	DWP/SWP-7 (Control)
<u>Required LLD</u> →	<u>4</u>	<u>4</u>	<u>4</u>
1st	<3.35	5.95	3.06
2nd	4.28	3.13	2.84
3rd	1.38	<2.09	1.33
4th	1.44	1.41	4.05

* DWG-2 changed to DWF-2 effective 03-14-02 revision 7, UNT-005-014

Table 3.2
Sample Type: Drinking/Surface Water
Analysis Iodine-131
Units: pCi/l

Collection Date	*DWG/SWG-2 (Indicator)	DWE/SWE-5 (Indicator)	DWP/SWP-7 (Control)
<u>Required LLD</u> →	<u>1</u>	<u>1</u>	<u>1</u>
01-02-02	<0.85	<0.88	<0.88
01-28-02	<0.76	<0.86	<0.80
02-25-02	<0.84	<0.80	<0.75
03-25-02	<0.89	<0.82	<0.89
04-22-02	<0.87	<0.90	<0.83
05-20-02	<0.90	<0.88	<0.90
06-17-02	<0.89	<0.83	<0.88
07-15-02	<0.85	<0.88	<0.89
08-12-02	<0.82	<0.89	<0.79
09-09-02	<0.89	<0.73	<0.89
10-07-02	<0.87	<0.73	<0.89
11-04-02	<0.87	<0.86	<0.87
12-03-02	<0.90	<0.90	<0.89
12-30-02	<0.88	<0.88	<0.89

* DWG-2 changed to DWF-2 effective 03-14-02 revision 7, UNT-005-014

Table 3.3

Sample Type: Drinking/Surface Water

Analysis: Gamma Isotopic

Units: pCi/l

Location	Collection Date	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
<u>Required LLD</u>	→	<u>15</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>30</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>18</u>	<u>60</u>	<u>15</u>
*DWG/SWG-2 (Indicator)	03-25-02	<4.45	<8.39	<4.61	<3.61	<6.12	<9.77	<2.98	<4.78	<5.49	<17.8	<5.39
DWE/SWE-5 (Indicator)	03-25-02	<3.88	<4.18	<6.68	<4.18	<7.20	<4.47	<3.16	<4.11	<3.18	<12.2	<5.63
DWP/SWP-7 (Control)	03-25-02	<5.43	<11.9	<11.9	<6.21	<11.3	<6.65	<4.58	<4.42	<5.85	<22.1	<6.67
*DWG/SWG-2 (Indicator)	06-17-02	<3.54	<6.83	<3.16	<3.86	<5.31	<5.98	<3.70	<4.37	<3.32	<12.5	<6.03
DWE/SWE-5 (Indicator)	06-17-02	<3.96	<5.95	<4.14	<3.40	<6.59	<5.35	<2.82	<3.01	<3.92	<12.7	<4.94
DWP/SWP-7 (Control)	06-17-02	<3.62	<4.50	<3.03	<3.92	<6.28	<5.66	<3.21	<3.53	<4.00	<13.3	<4.62
SWK-1 (Indicator)	06-17-02	<5.69	<10.80	<5.74	<3.80	<10.20	<7.16	<4.41	<4.32	<3.50	<19.30	<5.07
*DWG/SWG-2 (Indicator)	09-09-02	<4.81	<8.08	<2.93	<5.81	<12.0	<11.1	<5.34	<6.63	<7.41	<22.9	<8.94
DWE/SWE-5 (Indicator)	09-09-02	<7.25	<12.0	<5.45	<5.57	<12.5	<7.60	<4.51	<4.58	<4.94	<21.6	<7.20
DWP/SWP-7 (Control)	09-09-02	<3.46	<9.65	<4.14	<5.11	<8.61	<8.82	<5.45	<4.45	<4.85	<16.6	<6.22
SWK-1 (Indicator)	09-09-02	<4.37	<12.40	<5.42	<3.80	<11.30	<9.51	<6.20	<5.54	<5.95	<21.70	<6.32
*DWG/SWG-2 (Indicator)	12-03-02	<5.64	<8.60	<5.39	<4.43	<8.01	<6.41	<5.70	<4.56	<4.89	<21.4	<8.19
DWE/SWE-5 (Indicator)	12-03-02	<4.96	<7.73	<3.58	<3.54	<8.56	<5.99	<5.22	<3.87	<3.68	<19.0	<4.94
DWP/SWP-7 (Control)	12-03-02	<5.96	<9.03	<4.34	<7.22	<12.4	<9.54	<6.87	<3.76	<5.66	<13.3	<11.3
SWK-1 (Indicator)	12-03-02	<5.14	<7.76	<3.96	<5.91	<9.96	<7.46	<5.14	<5.06	<5.03	<20.10	<4.74

* DWG-2 changed to DWF-2 effective 03-14-02 revision 7, UNT-005-014

Table 3 4
Sample Type: Drinking/Surface Water
Analysis: Tritium
Units: pCi/l

Quarter		*DWG/SWG-2 (Indicator)	DWE/SWE-5 (Indicator)	**SWK-1 (Indicator)	DWP/SWP-7 (Control)
	<u>Required LLD</u> →	<u>2000</u>	<u>2000</u>	<u>2000</u>	<u>2000</u>
1st		<554.04	<534.94	n/a	<568.78
2nd		<554.88	<555.25	2297	<552.42
3rd		<591.59	<588.10	4670	<590.47
4th		<597.01	<593.96	4126	<597.87

* DWG-2 changed to DWF-2 effective 03-14-02 revision 7, UNT-005-014
** GWK-1 changed to SWK-1 effective 03-14-02 revision 7, UNT-005-014

Table 4.1
Sample Type: Ground Water
Analysis: Gamma Isotopic
Units: pCi/l

Location	Collection Date	H-3	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95	Nb-95	Cs-134	Cs-137	Ba-140	La-140
<u>Required LLD</u>	→	<u>2000</u>	<u>15</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>30</u>	<u>30</u>	<u>15</u>	<u>15</u>	<u>18</u>	<u>60</u>	<u>15</u>
*GWK-1 (Indicator)	01-14-02	1190	<5.10	<9.47	<4.68	<3.11	<12.30	<5.80	<5.92	<6.67	<4.67	<16.20	<3.88
	**01-14-02	1449	<3.60	<6.10	<4.67	<3.25	<8.98	<6.47	<4.27	<4.85	<4.46	<16.00	<5.89

* GWK-1 changed to SWK-1 effective 03-14-02 revision 7, UNT-005-014
** Duplicate sample

Table 5.1

Sample Type: Sediment
Analysis: Gamma Isotopic
Units: pCi/kg (dry)

Location	Collection Date	Mn-54	Co-58	Co-60	Cs-134	Cs-137
<u>Required LLD</u>	→	<u>n/a</u>	<u>n/a</u>	<u>n/a</u>	<u>150</u>	<u>180</u>
SHWK-1 (Indicator)	04-22-02	<35.6	<29.4	<29.0	<33.3	69.3
SHWE-3 (Indicator)	05-06-02	<31.9	<27.5	<33.8	<28.4	<32.0
*SHWQ-6 (Control)	04-22-02	<42.0	<36.7	<38.8	<35.1	<42.3

* Added to the program effective 03-14-02 revision 7, UNT-005-014

Table 6.1

Sample Type Milk

Analysis: Iodine-131 and Gamma Isotopic

Units: pCi/l

Location	Collection Date	I-131	Cs-134	Cs-137	Ba-140	La-140
	<u>Required LLD</u> →	<u>1</u>	<u>15</u>	<u>18</u>	<u>60</u>	<u>15</u>
MKQ-5	01-15-02	<0.81	<7.58	<7.64	<26.5	<6.54
MKR-40	01-14-02	<0.63	<6.67	<8.54	<26.6	<7.31
MKQ-5	02-19-02	<0.87	<6.49	<7.40	<20.5	<5.86
MKR-40	02-18-02	<0.74	<6.19	<5.90	<21.1	<6.12
MKQ-5	03-19-02	<0.75	<5.40	<6.63	<19.3	<4.59
MKR-40	03-18-02	<0.74	<8.70	<8.62	<22.0	<10.2
*MKQ-5	06-18-02	n/a	n/a	n/a	n/a	n/a
MKR-40	06-17-02	<0.86	<7.95	<9.65	<27.3	<8.34
**MKE-3	09-17-02	<0.86	<9.23	<12.10	<12.30	<34.5
*MKQ-5	09-17-02	n/a	n/a	n/a	n/a	n/a
MKR-40	09-15-02	<0.90	<5.42	<9.30	<21.7	<6.21
**MKE-3	12-17-02	n/a	n/a	n/a	n/a	n/a
*MKQ-5	12-17-02	n/a	n/a	n/a	n/a	n/a
MKR-40	12-16-02	<0.77	<6.77	<8.71	<24.5	<6.06

* Removing from the program, owner sold cows

** Added to the program in 3rd quarter of 2002

Table 7.1
Sample Type: Fish
Analysis: Gamma Isotopic
Units: pCi/kg (dry)

Location	Collection Date	Species	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Cs-134	Cs-137
<u>Required LLD</u>	→		<u>130</u>	<u>260</u>	<u>130</u>	<u>130</u>	<u>260</u>	<u>130</u>	<u>150</u>
FH-1 (Control)	11-06-02	Carp	<16.7	<71.9	<23.3	<18.4	<50.7	<13.7	<16.4
FH-1 (Control)	11-06-02	Catfish	<20.0	<65.5	<22.5	<15.9	<47.6	<16.6	<18.2
FH-1 (Control)	11-06-02	Shad	<21.2	<87.1	<21.6	<24.8	<57.1	<17.0	<18.6
FH-1 (Control)	11-06-02	Mullet	<19.3	<93.3	<27.4	<19.0	<60.0	<19.3	<23.1
FH-2 (Indicator)	11-08-02	Carp	<13.4	<50.6	<10.6	<22.3	<45.0	<12.5	<17.1
FH-2 (Indicator)	11-08-02	Catfish	<10.1	<43.2	<14.5	<7.51	<26.0	<9.53	<10.4
FH-2 (Indicator)	11-08-02	Mullet	<19.5	<51.8	<27.6	<13.8	<44.7	<16.2	<19.8
FH-2 (Indicator)	11-08-02	Buffalo	<18.0	<9.6	<19.2	<22.7	<56.0	<13.0	<16.7
*FH-3 (Indicator)	11-07-02	Carp	<10.6	<67.6	<23.0	<19.7	<45.1	<15.2	<14.1
FH-3 (Indicator)	11-07-02	Catfish	<12.8	<47.3	<14.3	<12.6	<52.7	<12.3	<13.6
FH-3 (Indicator)	11-07-02	Shad	<13.5	<50.5	<16.7	<16.8	<35.9	<12.9	<11.9
FH-3 (Indicator)	11-07-02	Mullet	<16.2	<63.4	<27.3	<22.1	<38.8	<15.0	<15.1

* Added to the program effective 03-14-02 revision 7, UNT-005-014

Table 8.1

Sample Type: Broad Leaf Vegetation

Analysis: Iodine-131 and Gamma Isotopic

Units: pCi/kg (wet)

Location	Collection Date	I-131	Cs-134	Cs-137
<u>Required LLD</u>	→	<u>60</u>	<u>60</u>	<u>80</u>
BLQ-1 (Indicator)	01-08-02	<54.6	<34.0	<31.5
BLQ-1 (Indicator)	02-04-02	<53.0	<29.7	<26.4
BLQ-1 (Indicator)	03-04-02	<45.8	<29.5	<31.8
BLQ-1 (Indicator)	06-05-02	<59.9	<30.2	<30.7
BLQ-1 (Indicator)	09-10-02	<57.3	<31.5	<17.9
BLQ-1 (Indicator)	12-04-02	<42.0	<41.3	<45.3
BLB-1 (Indicator)	01-08-02	<59.6	<38.0	<39.5
BLB-1 (Indicator)	02-04-02	<58.4	<41.4	<45.5
BLB-1 (Indicator)	03-04-02	<38.2	<42.3	<33.5
BLB-1 (Indicator)	06-05-02	<59.2	<35.0	<34.0
BLB-1 (Indicator)	09-10-02	<50.7	<38.8	<46.7
BLB-1 (Indicator)	12-04-02	<60.0	<37.0	<46.3

Table 8.1 (continued)

Sample Type. Broad Leaf Vegetation

Analysis: Iodine-131 and Gamma Isotopic

Units: pCi/kg (wet)

Location	Collection Date	I-131	Cs-134	Cs-137
<u>Required LLD</u>	→	<u>60</u>	<u>60</u>	<u>80</u>
BLK-15 (Control)	01-08-02	<58.3	<41.2	<35.5
BLK-15 (Control)	02-04-02	<55.9	<33.4	<43.3
BLK-15 (Control)	03-04-02	<35.7	<43.5	<37.6
*BLK-15 (Control)	06-05-02	n/a	n/a	n/a
*BLK-15 (Control)	09-10-02	n/a	n/a	n/a
*BLK-15 (Control)	12-04-02	n/a	n/a	n/a
BLE-20 (Control)	01-08-02	<58.2	<36.5	<28.8
BLE-20 (Control)	02-04-02	<59.8	<39.6	<46.2
BLE-20 (Control)	03-04-02	<31.9	<34.9	<36.0
BLE-20 (Control)	06-05-02	<59.5	<43.2	<43.9
BLE-20 (Control)	09-10-02	<56.4	<47.1	<54.8
BLE-20 (Control)	12-04-02	<37.1	<37.2	<35.3

* Removed from the program effective 03-14-02 revision 7, UNT-005-014

Table 9 1
Sample Type: Interlaboratory Comparison
Analysis: Gross Beta, Iodine-131, Tritium and Gamma Isotopic

Sample Type (units)	Study	Date	Analysis	"Known" Value ^a	RBS Value	RBS N-DEV ^b	RBS N-RANGE ^c	
Charcoal Cartridge (pCi/cartridge)	E3236-125	6/13/02	I-131	94 0 ± 16 28	93 4	-0 12	0 358	
Water (pCi/liter)	E3049-125	3/14/02	BETA	130 ± 22 5	137	0 98	0 273	
			CR-51	198 ± 34 3	209	0.96	0 776	
				MN-54	166 ± 28.7	177	1.11	0 605
				FE-59	86 0 ± 14 9	97.8	2 37	0 103
				CO-60	117 ± 20 3	116	-0 10	0 252
				ZN-65	164 ± 28 4	176	1 27	0 432
				I-131	61 0 ± 10 6	58 7	-0 65	0 271
				CS-134	91.0 ± 15 8	89 8	-0 23	0 032
				CS-137	197 ± 34 1	196	-0 06	0 120
				CE-141	242 ± 41.9	241	-0 05	0 024
	E3048-125 (Duplicate)	3/14/02	CR-51	198 ± 34 3	204	0 52	0 955	
			MN-54	166 ± 28 7	179	1.36	0 320	
			FE-59	86 0 ± 14 9	96 4	2 09	1.264	
			CO-60	117 ± 20 3	113	-0 64	0 404	
			ZN-65	164 ± 28 4	176	1 30	0 864	
			I-131	61.0 ± 10 6	62.7	0.47	0 504	
			CS-134	91.0 ± 15 8	89.0	-0.37	0 435	
			CS-137	197 ± 34.1	202	0 41	0.420	
				CE-141	242 ± 41.9	243	0 05	0.073
	E3235-125	6/13/02	H-3	6970 ± 1207	7298	0 82	0 217	
Air Filter (pCi/filter)	E3323-125	9/12/02	BETA	69 0 ± 11.95	73 4	1 11	0 094	
			CR-51	171 ± 29 6	178	0 68	1 105	
				MN-54	115 ± 19 9	132	2 61	0 308
				CO-58	73 0 ± 12.6	77.2	1.00	0 372
				FE-59	67 0 ± 11.6	80 8	3 57 ^d	0 062
				CO-60	112 ± 19 4	124	1.86	0 422
				ZN-65	141 ± 24 4	156	1.84	0 628
				CS-134	99 0 ± 17.2	99.4	0.08	0.024
				CS-137	95 0 ± 16 5	103	1.46	0 249
			CE-141	120 ± 20 8	133	1 83	0 148	

Table 9 1
 Sample Type: Interlaboratory Comparison
 Analysis: Gamma Isotopic

Sample Type (units)	Study	Date	Analysis	"Known" Value ^a	RBS Value	RBS N-DEV ^b	RBS N-RANGE ^c
Sediment (pCi/gram)	E3383-125	9/12/02	CR-51	0 354 ± 0 061	0 366	0 603	0 818
			MN-54	0 238 ± 0 041	0 266	2 038	0 347
			CO-58	0 151 ± 0 026	0 159	0 956	0 196
			FE-59	0 138 ± 0 024	0 150	1.464	0 300
			CO-60	0 232 ± 0 040	0 243	0 846	0 229
			ZN-65	0 293 ± 0 051	0 330	2.207	0 403
			CS-134	0 205 ± 0 036	0 204	-0.056	0 288
			CS-137	0 282 ± 0 049	0 323	2.539	0 105
			CE-141	0 249 ± 0 043	0 272	1.577	0 735

NOTES

- (a) The "known" values are listed with a range reflecting control (3 sigma) limits
 (b) The normalized deviation from the "known" value is computed from the deviation and the standard error of the mean; ±2 000 is the warning limit and ±3 000 is the control limit This is a measure of accuracy of the analytical methods
 (c) The normalized range is computed from the mean range, the control limit, and the standard error of the range, +2 000 is the warning limit and +3 000 is the control limit This is a measure of precision of the analytical methods
 (d) The results reported were out of the control limits

Interlaboratory Comparison Program Exceptions

There was one result outside the control limits for accuracy in the 2002 cross check program participation studies. This result was in a gamma isotopic analysis of an air particulate filter sample.

The study results outside the control limits for accuracy was in the analysis of the nuclide Fe-59 in sample study 3382-125 of 9/12/2002. RBS normalized-deviation for the analysis was +3.57 with control limits of ± 3.00 . This high bias result is conservative and is considered as having no impact on past results of the program. The high bias result for Fe-59 is contributed to coincidence summing effects. A coincidence summing correction was employed in the past, but was discontinued due to the production of non-conservative low-bias results. Fe-59 results were all within control limits in other cross check samples for the year 2002.

ATTACHMENT 2

Statistical Comparisons

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Statistical Analyses

◆ Calculation of the Mean and Standard Deviation

The mean and standard deviation for different groups of analyses are calculated using the following equations:

$$\bar{X} = \sum_{i=1}^n \frac{X_i}{n}$$

and

$$S = \left(\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)} \right)^{0.5}$$

where:

X = mean of sample population,
S = standard deviation of sample population,
n = number of samples in sample population, and
X_i = value of the i'th sample.

◆ **Comparing Two Sample Population Means**

The means of two sample populations are compared for statistical difference using the standard "t" test. The use of the test requires the assumption that the data within the populations are normally distributed and that the true standard deviations of the mean are equal for both populations. The standard "t" test tests the hypothesis that the true means of both populations are equal. The "t" value can be calculated from the equation below (obtained from the CRC Standard Mathematical Tables, 26th Edition (1981)):

$$t = \frac{\bar{X} - \bar{Y}}{\left(\frac{(n_x - 1)S_x^2 + (n_y - 1)S_y^2}{n_x + n_y - 2} \right)^{0.5} \left(\frac{1}{n_x} + \frac{1}{n_y} \right)^{0.5}}$$

where:

- t = calculated "t" value,
- X = mean of first data set,
- Y = mean of second data set,
- n_x = number of variables in first data set,
- S_x = standard deviation of first data set,
- n_y = number of variables in second data set, and
- S_y = standard deviation of second data set.

The calculated "t" value is used to test the hypothesis that the true mean of the first population (m_x) is equal to the true mean of the second population (m_y) assuming that the true standard deviation of both populations are equal (m_x = m_y). The calculated "t" value is compared to a tabular "t" value such that

- a. if t > t_{μ,n} then reject the hypothesis when m_x > m_y,
- b. if t < -t_{μ,n} then reject the hypothesis when m_x < m_y,
- c. if t > t_{μ/2,n} then reject the hypothesis when m_x = m_y,

where t_{μ/2,n} and t_{μ,n} are the tabular "t" values, with a preselected error (5%), confidence level (1 - μ) or (1 - μ/2), and degrees of freedom n = n_x + n_y - 2. Tabular values of the "t" were obtained from the CRC Standard Mathematical Tables, 26th Edition (1981)

TABLE 2.1

STATISTICAL COMPARISON OF 2002 TLD MEASUREMENTS FROM STATIONS GROUPED BY DISTANCE			
	Stations Located 0-2 Miles from the Plant	Stations Located 2-5 Miles from the Plant	Stations Located more than 5 Miles from the Plant
Mean (mRem/std.qtr.)	11.08	11.33	10.89
Standard Deviation (mRem/std. qtr.)	1.54	1.21	1.65
Number in Sample	63	26	27
Calculated "t" Value (comparison of stations 0-2 and 2-5 miles from the plant to stations >5 miles from the plant)	0.52	1.10	NA*
Tabular "t" Value at 95% Confidence($t_{0.025,n}$)	1.991(a)	2.009(b)	NA*

(a) Results indicate the mean for stations located 0-2 miles and 2-5 miles from the plant are statistically identical to the mean for stations located more than 5 miles from the plant.

(b) Although the TLD stations located 2-5 miles from the plant are statistically higher than those located more than 5 miles from the plant, the quarterly doses measured in 2002 are consistent with historical data at each location as shown in Table 2.2.

- Not Applicable

TABLE 2.2

STATISTICAL COMPARISON OF 2002 TLD RADIATION DOSE TO HISTORICAL DATA BY LOCATION

Units: mrem/Std. Qtr.

Station	1990 - 2001 Avg**	1990 - 2001 Std. Dev.**	1990 - 2001 Range**		2002 Avg**	2002 Std Dev**	2002 Range**	
A-2	13.8	1.3	11	18	12.0	0.8	11	13
A-5	13.3	1.4	11	17	10.8	0.5	10	11
B-1	13.3	1.5	11	19	11.3	0.5	11	12
B-4	13.5	1.2	12	17	12.5	0.6	12	13
C-1	9.2	1.4	7	13	8.8	0.5	8	9
D-2	12.1	2.3	8	19	12.0	1.0	11	13
D-5	12.3	1.7	9	18	10.8	1.0	10	12
E-1	11.4	1.3	10	16	10.3	0.5	10	11
E-5	12.2	1.7	9	17	10.7	0.6	10	11
E-15	11.6	1.9	8	16	9.0	0.8	8	10
E-30*	11.3	1.8	8	17	9.3	0.5	9	10
F-2	12.1	1.3	10	17	11.0	0.8	10	12
F-4	14.4	1.6	11	19	13.0	0.8	12	14
F-9	12.6	1.7	7	17	11.5	1.0	11	13
G-2	15.2	1.3	12	19	13.8	1.0	13	15
G-4	11.5	1.4	9	16	10.0	1.0	9	11
G-9	12.6	2.0	9	19	9.5	0.6	9	10
H-2	13.4	1.2	11	18	11.5	1.0	11	13
H-6	12.3	1.3	10	17	11.7	1.2	11	13
J-2	12.8	1.6	11	17	11.5	0.6	11	12
J-15	12.9	1.4	11	17	12.3	1.0	11	13
K-1	11.5	1.5	9	16	11.0	0.8	10	12
L-1	12.9	1.4	10	16	11.8	0.5	11	12
M-1	12.2	1.6	10	18	11.0	1.4	10	13
N-1	13.5	1.7	8	18	12.3	1.0	11	13
P-1	10.3	1.4	8	15	9.0	0.0	9	9
P-6	13.6	1.6	11	19	13.0	1.4	12	15
Q-1	12.3	1.3	10	16	11.3	0.5	11	12
Q-5	14.5	1.8	9	18	10.8	0.5	10	11
R-1	11.2	1.4	9	15	8.5	1.9	6	10
R-6	13.2	2.6	9	18	9.5	0.6	9	10

* Control Location

** Significant outliers were removed from data sets.

PERS data indicates an average of 20 mrem for all indicator locations with a range of 11 to 33 and an average control of 18 mrem.

TABLE 2.3

STATISTICAL COMPARISON OF 2002 GROSS BETA ACTIVITY MEASUREMENTS ON AIR PARTICULATE FILTERS					
SAMPLE STATION	APG-1	APQ-1	APP-1	APC-1	APE-30
Mean (10^{-3} pCi/m ³)	18.4	19.0	19.2	18.1	18.8
Standard Deviation (10^{-3} pCi/m ³)	5.97	6.10	5.61	5.90	6.30
Number in Sample	26	26	24	26	26
Calculated "t" Value (comparison of the indicator stations to the control station)	0.20	0.13	0.28	0.40	NA*
Tabular "t" Value at 95% Confidence ($t_{0.025,n}$)	2.011(a)	2.011(a)	2.013(a)	2.011(a)	NA*

(a) Results indicate the mean for the indicator stations is statistically identical to the mean for the control station.

* Not Applicable

TABLE 2.4

STATISTICAL COMPARISON OF 2002 GROSS BETA ACTIVITY MEASUREMENTS IN DRINKING/SURFACE WATER SAMPLES			
	DWG-2	DWE-5	DWP-7
Mean (pCi/liter)	2.4	3.5	2.8
Standard Deviation (pCi/liter)	1.4	1.9	1.0
Number in Sample	3	3	4
Calculated "t" Value (comparison of the indicator stations to the control station)	0.49	0.56	NA*
Tabular "t" Value at 95% Confidence ($t_{0.025,n}$)	2.571(a)	2.571(a)	NA*

(a) Results indicate the mean for the indicator stations is statistically identical to the mean for the control station.

* Not Applicable

ATTACHMENT 3

2002 REVISED ODCM TABLES

SAMPLE	LOCATION	ANALYSIS	FREQUENCY*	VOLUME
TLD	A-2, B-1, C-1, D-2, E-1, F-2, G-2, H-2, J-2, K-1, L-1, M-1, N-1, P-1, Q-1, R-1, A-5, B-4, D-5, E-5 F-4, G-4, H-8, P-6, Q-5 R-6, F-9, G-8, E-15, J-15 E-30	TLD ⁽¹⁾	Quarterly	N/A
Radioiodine and Particulates	APP-1, APQ-1, APF-1, APC-1, APE-30	Gross beta ⁽²⁾ , I-131	Bi-Weekly	285m ³ /wk
		γ isotopic ⁽²⁾	Quarterly composite	3700m ³ /qtr
Ground Water	NONE	NONE	NONE	NONE
Drinking Water/ Surface Water ⁽³⁾	DWF-2 ⁽⁴⁾ /SWF-2 ⁽⁴⁾ DWP-7/SWP-7 DWE-5 ⁽⁴⁾ /SWE-5 ⁽⁴⁾ SWK-1	H-3	Quarterly composite ⁽⁵⁾	Homogeneous 8 liters
		Gross beta, γ isotopic	Quarterly composite ⁽⁵⁾	
		I-131 ⁽⁷⁾	Monthly composite ⁽¹⁰⁾	
Shoreline Sediment	SHWE-3, SHWK-1, SHWQ-6	γ isotopic	Annually	2 Kilograms
Milk	MKQ-5, MKR-40	γ isotopic, I-131	Quarterly	8 liters
Fish	FH-1, FH-2, FH-3	γ isotopic	In season or Annually ⁽⁹⁾	500 grams
Broad Leaf	BLQ-1, BLB-1, BLE-20	γ isotopic, I-131	Quarterly	500 grams
Sanitary System ⁽¹¹⁾	SWR-1	γ isotopic	Monthly Composite ⁽¹⁰⁾	Homogeneous 1 Liter

*Sample collection at specific locations may be increased at any time in order to increase the effectiveness of the REMP program.

1. One or more instrument, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. A TLD is considered one phosphor; two or more phosphors in a packet are considered two or more dosimeters. Geographical limitations affect siting of dosimeters.
2. Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples. Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.
3. Drinking Water and Surface Water samples are identical where designated.
4. The downstream sample is beyond the mixing zone.
5. A composite sample will contain aliquots of sample taken proportional to the quantity of flowing liquid that results in a specimen representative of the liquid flow.
6. DELETED
7. This analysis will be performed when the dose calculated for the consumption of water is greater than 1 mrem per year as calculated for maximum organ and age group.
8. DELETED
9. Striped mullet, gizzard shad, freshwater drum, and catfish will be collected. If they are not available, then substitute species will be collected and identified in reporting.
10. An analysis frequency of every 4 weeks satisfies this requirement. The maximum frequency is monthly.
11. Sanitary System Sampling and analysis performed additionally for this location. This sampling requirement is not derived directly from REMP requirements, but it represents another possible environmental interface with the plant. Information from this sample location will not normally be included in the Annual Radiological Environmental Operating Report.

SAMPLE LOCATION TABLE

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
DIRECT RADIATION (TLD)			
A-2	(Eastbank) Located on a utility pole on LA 628 near the Zephirin L. Periloux Fire House.	188° 1.27	N 30.01381 W 90.46780
B-1	(Eastbank) On fence enclosing the transmission tower 0.3 miles west (up river) from Little Gypsy on LA 628.	200° 0.75	N 30.00576 W 90 46672
C-1	(Eastbank) On fence enclosing the Little Gypsy Cooling Water Intake on LA 628 near APC-1.	219° 0.67	N 30 00307 W 90.46401
D-2	(Eastbank) Located approximately 0.3 miles east of Little Gypsy Power Station on stop sign post located at the peak of the levee on the west entrance road through the Bonnet Carre Spillway.	238° 1.24	N 30.00471 W 90.45343

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
E-1	<p align="center"><u>DIRECT RADIATION (TLD) (continued)</u></p> <p>(Westbank) Located on utility pole along LA 18 approximately 0.3 miles east of Waterford 3 plant entrance.</p>	277° 0.41	N 29.99468 W 90.46437
F-2	(Westbank) Located on southeast corner of fence enclosure surrounding the Entergy substation, 0.2 miles south of LA 18 on LA 3142.	294° 1.15	N 29.98842 W 90.45387
G-2	(Westbank) Located on fence east of LA 3142 approximately 0.3 miles north of railroad overpass	309° 1.26	N 29.98371 W 90.45498
H-2	(Westbank) Located off LA 3142 on southwest edge of fence along shell road 0.4 miles north of LA 3127/3142 intersection	327° 1.54	N 29.97659 W 90.45753

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
J-2	<u>DIRECT RADIATION (TLD) (continued)</u>		
	(Westbank) Located on fence enclosure for valve station south of LA 3127 approximately 0.6 miles west of LA 3127/3142 intersection.		
K-1	(Westbank) Located on stop sign at entrance to Entergy Education Center on LA 3127.	23° 1.06	N 29.98153 W 90.47843
L-1	(Westbank) Located on gated entrance off of LA 3127, approximately 1.6 miles west of LA 3127/3142 intersection.	42° 1.06	N 29.98427 W 90.48314
M-1	(Westbank) Located on south gate of the Waterford 1 and 2 fuel oil storage tank enclosure.	67° 0.76	N 29.99148 W 90.48286
N-1	(Westbank) Located on pole at corner of Railroad Ave. and School House Road.	93° 0.98	N 29.99649 W 90.48739

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
P-1	<p align="center"><u>DIRECT RADIATION (TLD) (continued)</u></p> (Westbank) Located on fence enclosing air sample station APP-1.	119° 0.84	N 30.00158 W 90 48323
Q-1	(Westbank) Located on fence enclosing air sample station APQ-1.	132° 0.81	N 30.00355 W 90.48091
R-1	(Westbank) Located at Waterford 1 and 2 Cooling Water Intake Structure on east hand- rail approximately a quarter of the way down the catwalk.	147° 0.51	N 30.00181 <u>W 90 47564</u>
A-5	(Eastbank) Located on utility pole at intersection of Oswald Avenue and US 61.	177° 4.59	N 30.06212 W 90.47334
B-4	(Eastbank) Located on utility pole guidewire next to transmission tower south of weigh station on US 61 at St John/ St Charles Parish line.	197° 3 75	N 30.04717 W 90 45130

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
D-5	<p align="center"><u>DIRECT RADIATION (TLD) (continued)</u></p> <p>(Eastbank) Located on gate on shell road approximately 0.1 miles north of US 61/LA 48 intersection</p>	249° 4.09	N 30.01628 W 90.40730
E-5	(Eastbank) Located on the Norco Substation fence enclosure at the end of Wesco St. off of LA 48	266° 4.08	N 29.99840 W 90.40314
F-4	(Westbank) Located on utility pole behind house at 646 Aquarius St in Hahnville.	289° 3.53	N 29.97818 W 90.41582
G-4	(Westbank) Located on railroad sign on LA 3160 approximately 0.1 miles north of railroad track.	309° 3.30	N 29.96507 W 90.42867

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
	<u>DIRECT RADIATION (TLD) (continued)</u>		
H-8	(Westbank) Located on a road sign on south side of HWY 90 directly in front of Hahnville High School approximately 0.1 miles east of Tiger Dr...	331° 8.13	N 29.89178 W 90.40725
P-6	(Westbank) Located on a fence surrounding the communications tower at the LA 640/railroad track intersection.	107° 5.58	N 30.02121 W 90.55941
Q-5	(Westbank) Located on utility pole along LA 18 across from Mississippi River marker 137.	129° 5.01	N 30.04274 W 90.53464
R-6	(Eastbank) Located on fence enclosure approximately 0.2 miles west of US 61 on LA 3223 near railroad crossing	160° 5.52	N 30.07108 W 90.50183
F-9	(Eastbank) Located on entrance gate to Destrehan Substation just north of railroad tracks on Jonathan St. Jonathan St. is approximately 1.5 miles east of Luling-Destrehan Bridge, off of LA 48.	294° 8.18	N 29.94563 W 90.34739

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
G-8	<p style="text-align: center;"><u>DIRECT RADIATION (TLD) (continued)</u></p> <p>(Westbank) Located on southern most corner of the back fence of Entergy Office in Luling</p>	<p style="text-align: center;">305° 7.74</p>	<p style="text-align: center;">N 29.93055 W 90.36592</p>
E-15	(Eastbank) Located on Kenner Substation fence enclosure on Alliance Ave. approximately 0.1 miles from LA 48.	<p style="text-align: center;">275° 11.7</p>	<p style="text-align: center;">N 29.97695 W 90.27658</p>
J-15	(Westbank) Located on utility pole near the LA 631/Hwy 90 intersection in Des Allemands.	<p style="text-align: center;">357° 11.7</p>	<p style="text-align: center;">N 29.82575 W 90.46457</p>
E-30*	(Westbank) Located at entrance to the Entergy Office on Delaronde St in Algiers	<p style="text-align: center;">276° 25.2</p>	<p style="text-align: center;">N 29.95233 W 90.05441</p>

* DENOTES CONTROL LOCATIONS

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
AIRBORNE			
APP-1	(Westbank) Located in soybean/sugarcane field at northwest corner of Short St in Killona	119° 0.84	N 30 00158 W 90.48323
APQ-1	(Westbank) Located in soybean/sugarcane field off LA 18 approximately 0.6 miles east of LA 18/3141 intersection.	132° 0 81	N 30.00356 W 90.48093
APF-1	(Westbank) Located on north side of Secondary Meteorological Tower.	299° 0.35	N 29 99302 W 90.46601
APC-1	(Eastbank) Located inside the Little Gypsy Cooling Water Intake Structure fence enclosure.	219° 0.67	N 30.00307 W 90.46401
APE-30*	(Westbank) Located on the roof of the Energy Office building on Delaronde St. in Algiers.	276° 25.2	N 29 95289 W 90.05430

* DENOTES CONTROL LOCATIONS

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION <u>DESCRIPTION</u>	BEARING/ MILES TO PLANT	Position Latitude Longitude
BROAD LEAF			
BLQ-1	(Westbank) Located near air sample station APQ-1.	132° 0.83	N 30.00367 W 90 48132
BLB-1	(Eastbank) Located near transmission tower west of Little Gypsy on LA 628.	197° 0.81	N 30.00665 W 90.46691
BLE-20*	(Westbank) Located on property of Nine Mile Point in Westwego, LA	280° 19.7	N 29 94142 W 90.14909

* DENOTES CONTROL LOCATION(S)

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
	INGESTION		
	MILK		
MKQ-5	(Westbank) Located at the Webre's house on LA 18 across from Mississippi River marker 137.	129° 4.99	N 30.04224 W 90.53467
MKQ-40*	(Eastbank) Located at 24254 LA Hwy 442, Holden, LA.	166° 40 7	N 30.57102 W 90.62381
	FISH		
FH-1*	Upstream of the plant intake structure	N/A	N/A
FH-2	Downstream of the plant discharge structure.	N/A	N/A
FH-3	(Westbank) Waterways downstream of plant discharge directed to 40 Arpent Canal.	N/A	N/A

* DENOTES CONTROL LOCATIONS

N/A - Not Applicable for this sampling location.

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	<u>LOCATION DESCRIPTION</u>	BEARING/ MILES TO PLANT	Position Latitude Longitude
	WATERBORNE		
SWK-1	(Westbank) Located at 40 Arpent Canal south of the plant. The canal is northwest of the shell access road/railroad track intersection.	14° 0.49	N 29.98866 W 90.47324
SHWE-3	(Westbank) Located at Foot Ferry Landing off LA 18 in Taft.	276° 2.99	N 29.99063 W 90.42151
SHWK-1	(Westbank) Located at 40 Arpent Canal south of plant. The canal is northwest of the shell access road/railroad track intersection.	14° 0.49	N 29.98866 W 90 47324
SHWQ-6*	(Eastbank) Located off LA 628 approximately 0.1 miles east of Reserve ferry landing.	129° 5.99	N 30.05154 W 90.54748
DWE-5 SWE-5	(Eastbank) Located at St. Charles Parish Waterworks off LA 48 in New Sarpy.	277° 4.59	N 29.98622 W 90.39525
DWP-7* SWP-7*	(Westbank) Located at St John Parish Waterworks off LA 18 in Edgard	117° 7.37	N 30.04629 W 90.57931
DWF-2 SWF-2	(Westbank) Located Dow Chemical Plant drinking water canal.	302° 1.51	N 29.98371 W 90.44989

* DENOTES CONTROL LOCATIONS

SAMPLE LOCATION TABLE (Continued)

LOCATION NUMBER	LOCATION DESCRIPTION	BEARING/ MILES TO PLANT	Position Latitude Longitude
<u>SANITARY SYSTEM</u>			
SWR-1**	Sewage lift station NW of MSB between Protected Area Fence and LA 18 0.1 miles from the plant	153° 0.10	N 29.99684 W 90.47184

** Sampling requirements are not derived directly from REMP requirements therefore results will not appear in the annual report. However, it represents another possible environmental interface with the plant.