DOE/NV/13609-37

Assessing Potential Exposure from Truck Transport of Low-level Radioactive Waste to the Nevada Test Site

prepared by

Julianne J. Miller, David S. Shafer, Karen J. Gray, Bruce W. Church,
Scott A. Campbell, and Barbara A. Holz

submitted to

Nevada Site Office
National Nuclear Security Administration
U.S. Department of Energy
Las Vegas, Nevada

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Division of Hydrologic Sciences
Desert Research Institute
University and Community College System of Nevada

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Department of Energy
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Nevada Site Office
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MAY 6 2005

Julianne Miller, Principal Investigator
Desert Research Institute
755 E. Flamingo Road
Las Vegas, NV 89119-7363

Dear Julianne:

FINAL REPORT, ENTITLED: *ASSESSING POTENTIAL EXPOSURE FROM TRUCK TRANSPORT OF LOW-LEVEL RADIOACTIVE WASTE TO THE NEVADA TEST SITE*

We thank you and your associates for completing the subject report and request that this letter be published with the report.

The Desert Research Institute (DRI) has turned a vague concept, measurement of the actual gamma radiation exposure from truck transporting low-level radioactive waste to the Nevada Test Site, into reality. This document gives the reader an important insight into the complexities associated with the measurement of gamma radiation and how these measurements relate to the exposure to a member of the public. The results of this study indicate that individual truck and cumulative exposure measurements were well below relevant Department of Transportation and Environmental Protection Agency standards.

Although the Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) funded this study and has reviewed drafts of this report, it is important to understand that DRI is solely responsible for the content of this report. The NNSA/NSO will now initiate a process to consider the recommendations contained in the report.

Again, thank you for your dedication and hard work.

Sincerely,

E. Frank Di Sanza, Director
Waste Management Division

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EXECUTIVE SUMMARY

The United States (U.S.) Department of Energy (DOE) Nevada Test Site (NTS) is one of two regional sites where low-level radioactive waste (LLW) from approved DOE and Department of Defense generators is disposed of by shallow land burial. In fiscal year (FY) 2003, more than 91,000 m^3 (3.2 million ft^3) of LLW were transported by truck to the NTS. Over 85,000 m^3 (3.0 million ft^3) were disposed of in FY 2004, driven in part by the accelerated closure of DOE Environmental Management (EM) sites such as Mound, Fernald, and Rocky Flats. The DOE and Department of Transportation (DOT) regulations ensure that radiation exposure from truck shipments is negligible. Nevertheless, particularly in rural communities, there is perceived public risk about cumulative exposure, especially when LLW transportation routes and the main highway through towns are the same. The DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO), which manages the NTS, has agreed with the State of Nevada to restrict transport of LLW through the Las Vegas metropolitan area. Consequently, LLW generators primarily use highways through rural parts of Nevada and western Utah to reach the NTS.

The NNSA/NSO and other DOE offices have provided information on potential exposure to members of the public from LLW trucks as part of public outreach activities. However, based on literature searches and discussion with other researchers in the transportation field, nearly all of the information is based on calculated versus measured exposures, although measurements of trucks are made with portable, hand-held instruments when drivers arrive at such facilities as the Area 5 Radioactive Waste Management Complex (RWMC) or the Area 3 Radioactive Waste Management Site (RWMS) on the NTS. To help better address public concerns about potential exposure from LLW trucks, a stationary and automated array of four pressurized ion chambers (PICs) was established for LLW trucks to pass through just before they reached the NTS. The PICs were positioned 1.0 m (3.3 ft) from the truck trailer at a height of 1.5 m (5.0 ft) to simulate conditions of a citizen standing on a sidewalk next to a LLW truck on a standard two-lane highway in the U.S., and to be representative of the exposure of chest organs for a "Reference Man" using the Snyder-Fisher model of an adult human. The use of four PICs (two on each side of a truck) was to investigate, account, and correct for nonuniformity where gamma radiation levels from waste packages varied from side to side, and from front to back in the truck trailer. In addition to the PICs, photoacoustic sensors, positioned between the PICs on each side of the array, were used to detect when a truck entered and departed the array. Data from the PICs and photoacoustic sensors were recorded on dataloggers. All instruments were solar powered. Automating the array provided an objective and consistent means to measure and calculate exposure to gamma radiation.

Each PIC was calibrated by collecting readings from exposure to a known 189.2 micro (μ) Ci ^{137}Cs source. A calibration was first conducted in the field, and then the same PICs and dataloggers were calibrated again in the laboratory at the Desert Research Institute in Las Vegas. Last, an independent calibration was performed on one of the PICs by the Environmental Measurements Laboratory (EML), U.S. Department of Homeland Security, in New York, with a ^{226}Ra source. The EML calibration showed only a three percent difference in energy response, within the tolerance range for a variation in the detector energy for a PIC when comparing calibrations with two difference sources. However, because of periodic under-response in voltage and background measurements of

one of the PICs during operation of the array in the field, only the measurements from three PICs were used in determining background for calculating the "net exposure" from each truck.

A letter from the Waste Management Division Director at NNSA/NSO to all approved generators requested their truck drivers to participate in the study and provided instructions for using the PIC array. However, because DOE could not contractually require waste generators to participate, the database is biased to voluntary participants. Drivers parked their truck in a marked "footprint" within the array and recorded shipment information, including date, time, and Waste Shipment Identification Number (WSIN), into a logbook located at the PIC array. Data on 1,012 truck shipments were collected between February and December 2003, representing nearly 47 percent of all LLW truck shipments to the NTS during the study period. A slightly larger number of trucks passed through the array, but insufficient data were recorded by truck drivers to match PIC readings to a particular truck and WSIN. Consequently, these measurements were not included in the database presented herein. The remote location of the site, and the fact that drivers could arrive at the site 24 hours per day, made it infeasible and cost prohibitive to have a person present at the PIC array to direct drivers to use the array.

The dataloggers were programmed to continuously run, with PIC measurements collected at 5-sec intervals. The dataloggers were programmed to analyze these data at 2-min intervals, and record, for each 2-min interval, (1) the maximum 5-sec microRoentgens per hour (μR/h) value, (2) the minimum 5-sec μR/h value, and (3) the average of all 5-sec PIC readings. The photoacoustic sensors detected when a truck passed through the PIC array during a 2-min interval. It was assumed that it would take the driver longer than two minutes to enter the required information into the array logbook; however, particularly when the minimum recorded PIC value was at background, there was evidence that the truck may not have remained within the array for the entire 2-min period. In these cases, the 2-min averaged PIC readings would incorporate both measurements from the truck as well as background readings before or after the truck was in the array. As a consequence, the maximum PIC values were determined to be the most consistent and reliable measurements of an actual truck. Thus, the highest maximum value from the four PICs during a 2-min interval was selected as the gross measurement for the truck. Use of the maximum PIC reading was also consistent with procedures used at the Area 3 RWMS and Area 5 RWMC for recording measurements for trucks with portable instruments at the NTS.

Readings taken every two minutes when trucks were not present in the array were used to calculate two background values in military time: from 1946 (7:46 pm) to 0744 h (7:44 am) and 0744 to 1946 h. For consistency in using maximum exposure measurements from the trucks, the average of the maximum background values obtained during the specific 12-h window when a truck arrived at the PIC array, and the standard deviation of the background values, were subtracted from the gross reading of the truck to obtain net exposure values for each truck. Overall, background readings could vary from approximately 9 and 40 μR/h, although typically background readings ranged between 10 and 15 μR/h.

In addition, for each of the trucks, the WSIN was used to determine the route its driver used to reach the NTS so that potential exposures could be apportioned to particular towns along the routes. There were six potential routes during the study period that drivers traveling through Nevada or western Utah could have used to reach the NTS. However, for the shipments in the database, only four of the routes were used. Measurements from 10 of the 18 waste generators who sent LLW to the NTS during the study period contributed to the database. Although no data were collected from an additional eight generators, the 10 participating generators accounted for the vast majority (92 percent) of the waste shipments to the NTS when the PIC array was operating. Because of the voluntary nature of the study, the names of individual generators are not provided in the report.

Although manufacturer specifications for the Reuter-Stokes, Model RSS-131, PIC used in this study stated that the instrument would read to 1,000 μR/h, it was subsequently found that a second channel on the PIC had to be used for measurements over 800 μR/h, and even then, pursuant to the manufacturer, the "analog sensitivity output is invalid" for measurements between 800 and 1,000 μR/h (Reuter-Stokes, 2001). Of the 1,012 trucks measured, 59 had gross gamma readings at the PIC array greater than 800 μR/h.

To rectify this situation, when a record of 800 μR/h or greater occurred, the WSIN from the truckers' logbook was used to find the specific waste manifest sheet from the RWMC or RWMS records. The waste manifest sheets include the hand-held radiation instrument readings made by the LLW radiological control technicians (RCTs) at the RWMC and RWMS, using a Ludlum Model 3 gamma detector. The RCTs routinely record the gamma radiation measurements of the highest readings at the surface of the truck trailer, at 0.3 m (1.0 ft) distance from the trailer, at 1.0 m (3.3 ft) distance from the trailer, and at the truck cab, approximately 3.0 m (10.0 ft) distance from the trailer. In all, data from 77 trucks, including the 59 recorded at the PIC array, with gross measurements greater than 800 μR/h, were examined to evaluate whether the 1.0 m (3.3 ft) measurements at the Area 3 RWMS and the Area 5 RWMC could be substituted for the trucks with measurements greater than 800 μR/h at the PIC array.

Measurements at 1.0 m (3.3 ft) and at 0.3 m (1.0 ft) were normalized to readings taken on contact with the truck. Taking the thickness of the truck wall into account, the actual distances plotted were 0.022 m (0.072 ft), 0.322 m (1.07 ft), and 1.022 m (3.35 ft). The data were then evaluated to see if the slope of the resulting curve (gross gamma reading versus distance) and its standard deviation would suggest that the data behaved in a manner such that readings at 1.0 m (3.3 ft) were predictable. The standard deviation at 0.322 m (1.07 ft) was ± 17 percent, and the 1.022 m (3.35 ft) was ± 35 percent. However, the slope of the decrease of radiation intensity as a function of increasing distance was much lower, or "slower," than would be predicted than if the trucks had been treated as point or even line sources. The authors recommend further study on these phenomena. Based on the relatively low standard deviation, the measurements at the Area 5 RWMC at 1.0 m (3.3 ft) were used in the database for those trucks that measured greater than 800 μR/h at the PIC array. Another check of consistency between measurements taken at the PIC array and measurements taken at the RWMC was that, in all but one case, trucks measured at the PIC array that produced gross exposure values exceeding 800 μR/h also produced values at the RWMC that exceeded 800 μR/h as well, with the one exception at the RWMC reading 750 μR/hr.

For analyzing the data, five scenarios appropriate for rural transportation routes were developed, with the 1.0 m (3.3 ft) distance between the member of the public and the truck, and the time of exposure ranging from 15 sec to 8 h. For each scenario, the number of trucks that could have contributed to exposure was determined, and the total potential exposure based on the PIC array records for the trucks that traveled those routes to the NTS was calculated. Of the four routes used by trucks during the study period, nearly 58 percent passed through the towns of Tonopah, Beatty, and Goldfield, NV, before reaching the NTS. At both Ely, NV, and Tonopah, there are highway junctions where truck routes converge. Furthermore, once a truck driver reaches Ely, the only reasonable travel route to the NTS is through Tonopah, Beatty, and Goldfield because of LLW truck transport restrictions through the Las Vegas Valley.

For nearly half of the trucks measured at the PIC array (483 or 47.7 percent), the net exposure at a distance of 1.0 m (3.3 ft) was less than or equal to 0.0 μR/h, meaning that the truck was indistinguishable from variations in background and represented no potential exposure to a member of the public. An additional 206 trucks had exposures greater than zero, but equal to or less than 1 μR/h. Finally, nearly 80 percent of the population of trucks (802 of 1,012) had net exposures less than or equal to 10 μR/h. Although there are no shipping or exposure standards at 1.0 m (3.3 ft) distance, one relevant point of comparison is the DOT shipping standard of 10 millirems (mrem) per hour at 2.0 m (6.6 ft) distance. Assuming a one-to-one correspondence between Roentgens and Rems, then 903 trucks (89.2 percent of the trucks measured) had net exposures no greater than one percent of the DOT standard at 1.0 m (3.3 ft). In actuality, of course, had the distance at which the trucks were measured increased to 2.0 m (6.6 ft) where the DOT shipping standard is established, the net exposure would be even less because of the increase in distance, although based on the empirical data from the NTS, at a rate of decrease that may be slower than for either a point or line source. The highest value recorded at 1.0 m (3.3 ft) distance (11,970.9 μR/h, or 11.9 mR/h) was the only truck with a value greater than 10.0 mR/h.

Previous studies on potential exposure to the public from transporting LLW to the NTS either relied on calculated exposures (Davis *et al.*, 2002) or were based on a small population of trucks (e.g., 88) where a relatively high-background value of 50 μR/h (background value measured at the LLW disposal sites) was subtracted from the gross reading of the truck trailer as measured by portable, hand-held instruments (Gertz, 2001). This background value is considerably higher than values at the PIC array or at towns along transportation routes in the region. Nevertheless, if the dataset described herein was analyzed for net exposure using the 50-μR/h background value, then 84.5 percent of the trucks would be below background. This is a result not altogether different than the estimate made in Gertz (2001).

Cumulative exposures were calculated for the population of trucks that went through particular towns based on five exposure scenarios. These scenarios assume, however unlikely, that the same individual, or "reference man," was exposed to all the trucks measured in the study that traveled along particular transportation routes. For the cumulative exposure measurements, comparisons were made to exposure limits to the public in 10CFR834, Subpart B, "Radiation Dose Limits for Members of the Public," which, excluding radon and medical exposures, limits members of the public to an exposure no greater than 100 mrem/y from any licensed facility.

The cumulative exposure calculations highlight the nonGaussian nature of the data, with measurements dominated by a small percent of the trucks (5.4) with net exposures rates greater than 1,000 μR/h, or 1 mR/h. A scenario that has been commonly used by the NNSA/NSO is that of a person walking adjacent to a LLW truck for a period of 15 sec at a distance of 2.0 m (6.6 ft). In this study, this scenario was examined at a distance of 1.0 m (3.3 ft). Previously evaluations had been based on extrapolations of calculated truck exposures at 1.0 m (3.3 ft) to 2.0 m (6.6 ft) by treating the truck as either a line or a point source. As an example, if a person was along the side of the road when each of the 42 trucks measured from Route 2 went through Amargosa Valley, assuming the 15-sec exposure of Scenario 1, his or her cumulative exposure would be 3.0 μR. However, Amargosa Valley is a good example of the sensitivity of the higher measurements on total cumulative exposure. If the truck with the highest net exposure reading of 259.2 μR over a one-hour period is removed from the total net exposure calculation, then the cumulative exposure for Scenario 1 (15 sec) is reduced to 2.0 μR, or only 66 percent of the original cumulative exposure rate.

The probability of an individual receiving exposure from a truck, rather than a “reference man” cumulative exposure, may be a more meaningful perspective to an individual living in one of the communities along the transportation routes. For each of the five scenarios, the actual amount of time when an exposure might occur is comparatively short, and there is far more time when a LLW truck is not present along a route. However, for the purposes of this study, the assumption was made that an individual was present within 1.0 m (3.3 ft) of a truck when it passed through town; and thus, the potential for an exposure to a LLW truck was assumed to exist.

As previously discussed, a small number of trucks contribute the majority of potential cumulative exposures, but the probability of being exposed to one of those trucks is low. For example, of the 587 LLW trucks that traveled through Tonopah, 340 of these trucks had net exposure rates greater than 0.0 μR/h, and 54 of the trucks had net exposure rates greater than or equal to 1,000 μR/h. This results in the probability of an individual in Tonopah receiving a potential net exposure from any single truck to be 0.58, and to a truck with a net exposure rate greater than or equal to 1,000 μR/h to be only 0.09.

In conclusion, although this study suggests that members of the public may receive exposure that can be measured from a small percentage of LLW trucks coming to the NTS, the vast majority of trucks (89.2 percent) represent no more than one percent of the relevant standards (e.g., the DOT shipping exposure standard of 10 mrem/h at 2 m). For nearly 50 percent of the trucks measured, there would be no net exposure.

The dataset collected for this study is the largest the authors are aware of for systematically collected exposure data for LLW truck shipments, especially when they are in transit. In addition, because this study was based on measurements rather than calculations of exposure, recommendations for future studies of this type are provided.

ACKNOWLEDGMENTS

In addition to the authors, other DRI personnel contributed to this study including Craig Shadel, Lynn Karr, Stacey Sedano, Tammy Kluesner, Amy McKinney, and Kristen Self. DRI appreciates the assistance of Bechtel Nevada (BN) Waste Management Operations for providing copies of Waste Shipment Identification Numbers for trucks that passed through the PIC array as well as records of surveys of trucks taken at the Area 5 Radioactive Waste Management Complex and the Area 3 Radioactive Waste Management Site on the Nevada Test Site. Rose Denton of BN provided access and assistance with the Low-level Waste Information System for NTS that provided information on shipments per month. Lee Stevens of Navarro Engineering provided information on the number of shipments and approved generators, volumes of waste disposed of, and transportation routes. Last, the participation of waste generators was obviously critical to the study. The study was funded by the Waste Management Division, National Nuclear Security Administration Nevada Site Office through contract DE-AC52-00NV13609.

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LIST OF ACRONYMS

BN	Bechtel Nevada
CEMP	Community Environmental Monitoring Program
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DRI	Desert Research Institute
EM	Environmental Management
EML	Environmental Management Laboratory
FY	fiscal year
ICRP	International Committee on Radiation Protection
LLW	low-level radioactive waste
NCRP	National Council on Radiation Protection and Measurements
NNSA/NSO	National Nuclear Security Administration Nevada Site Office
nti	no truck identified
NTS	Nevada Test Site
PIC	pressurized ion chamber
RCT	radiological control technician
RS	Reuter-Stokes
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
US	United States
WSIN	Waste Shipment Identification Number

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INTRODUCTION

Since 1980, over 651,558 m^3 (23,000,000 ft^3) of low-level radioactive waste (LLW) have been disposed of at the Nevada Test Site (NTS) by shallow land burial. Since 1988, the majority of this waste has been generated at other United States (U.S.) Department of Energy (DOE) and Department of Defense (DoD) sites and facilities in the U.S. Between fiscal year (FY) 2002 and the publication date, the volumes of LLW being shipped by truck to the NTS increased sharply with the accelerated closure of DOE Environmental Management (EM) Program sites (DOE, 2002). The NTS is located 105 km (65 mi) northwest of Las Vegas, Nevada, in the U.S.

There continue to be public concerns over the safety of LLW shipments to the NTS. They can be broadly divided into two categories: (1) the risk of accidents involving trucks traveling on public highways; and (2) whether residents along transportation routes receive cumulative exposure from individual LLW shipments that pose a long-term health risk. The DOE and U.S. Department of Transportation (DOT) regulations ensure that radiation exposure from truck shipments to members of the public is negligible. Nevertheless, particularly in rural communities along transportation routes in Utah and Nevada, there is a perceived risk from members of the public about cumulative exposure, particularly when "Main Street" and the routes being used by LLW trucks are one in the same.

To provide an objective assessment of gamma radiation exposure to members of the public from LLW transport by truck, the Desert Research Institute (DRI) and the DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) established a stationary and automated array of four pressurized ion chambers (PICs) in a vehicle pullout for LLW trucks to pass through just outside the entrance to the NTS. The PICs were positioned at a distance of 1.0 m (3.3 ft) from the sides of the truck trailer and at a height of 1.5 m (5.0 ft) to simulate conditions that a member of the public (Turner, 1995) might experience if a truck were to pass while the person was on the side of the road, or if a truck were to come to a stop at a stoplight in one of the smaller towns along the transportation routes. The 1.0-m (3.3-ft) distance also allowed for comparison with gamma readings of trucks taken with portable, hand-held instruments at the two LLW disposal sites at the NTS: the Area 5 Radioactive Waste Management Complex (RWMC) and the Area 3 Radioactive Waste Management Site (RWMS). The purpose in automating the system was to provide the most objective and consistent measurement and calculation of radiation exposure from the trucks possible.

The array was set up in November 2002 and equipment was tested and calibrated over the next two months. Data collection on trucks began on February 13, 2003, and continued to the end of December 2003. In all, external gamma readings were collected from 1,012 of the 2,260 trucks that delivered LLW to the NTS during this period. Because DOE could not contractually require waste generators to participate in the study, the database is biased toward voluntary participants; however, data were collected from the 10 generators that represented 92 percent of the LLW shipments to the NTS during the study period, with another eight generators accounting for the balance of the shipments. Because of the voluntary nature of the participation, the identity of the waste generators is not used in the report.

Previous studies on potential exposure to the public from transporting LLW to the NTS either relied on calculated exposures (Davis *et al.*, 2002) or was based on a small population of trucks (e.g., 88) where a relatively high-background value of 50 microRoentgens per hour (μR/h) (background value measured at the LLW disposal sites) were subtracted from the gross reading of the truck trailer as measured by portable, hand-held instruments (Gertz, 2001). The dataset that resulted from the DRI study is the largest collection of measurements of LLW trucks in transit of which the authors are aware.

BACKGROUND

The Role of the NTS as a Regional LLW Disposal Site

The NNSA/NSO EM Program supports the DOE complex by maintaining essential capability to dispose of LLW at the NTS from approved generators from across the DOE complex. This role was codified in the 1997 Waste Management Programmatic Environmental Impact Statement when the NTS was designated as one of two regional disposal sites for LLW. It is anticipated that the NTS will continue to be used by off-site generators until at least 2021 (DOE, 2002). Bechtel Nevada (BN) operates the two LLW disposal facilities at the NTS: the Area 5 RWMC and the Area 3 RWMS.

Presently, 29 DOE and DoD off-site generators from across the U.S. are approved for disposal of LLW at the NTS. This is in addition to disposal of LLW generated by NNSA/NSO's own EM activities, although this has amounted to less than one percent of the LLW disposed of in the last three years. With the DOE EM Program accelerating cleanup at several key sites between FY2002 and FY 2006, volumes of LLW being disposed at the NTS have substantially increased. In FY 2003, 91,777 m^3 (3,239,720 ft^3) of LLW was transported by truck from off-site generators to the NTS, the largest amount disposed of at the NTS in a single year. In addition, over 85,000 m^3 (3,000,000 ft^3) were disposed of in FY 2004.

<u>Standards and Dose Limits for LLW Truck Shipments</u>

There are no gamma radiation exposure limits *per se* for LLW truck shipments. However, the DOT, in addition to regulating packaging, labeling, handling, marking, and placarding of trucks and train cars used for LLW shipments, also has shipping-standard dose rate limits for "closed," exclusive-use vehicles such as trucks being used for delivering LLW to the NTS (DOE, 1999). Standards include 2 millirems per hour (mrem/h) to the driver in the truck cab, 200 mrem/h at contact with the truck trailer, and 10 mrem/h at 2.0 m (6.6 ft) distance. For cumulative exposure and dose, applicable regulations and standards in the U.S. assume that the average person is exposed to a total effective dose equivalent of 360 mrem/y from all sources (NCRP, 1987). Also relevant are both 10CFR834, Subpart B, "Radiation Dose Limits for Members of the Public," and International Committee on Radiation Protection (ICRP) public dose limits. With the exception of radon (public exposure of which is regulated separately), ICRP and Subpart B limit exposure to members of the public from any licensed facilities (excluding medical) to 100 mrem/y.

Major Truck Routes and Travel Restrictions for LLW Trucks

Six major trucking routes were used for transporting LLW through Nevada and western Utah to the NTS during the study period (Table 1 and Figure 1). As shown in Table 1, these six routes typically combine two or more of the DOE numbered routes, which are generally minor route variations or detours along major trucking routes, but also include interstate travel routes across the country. The six routes illustrated in Table 1 and Figure 1 are only those portions of the routes that pass through towns where a Community Environmental Monitoring Program (CEMP) station is located in Nevada. The towns of Delta and Cedar City, Utah, both along LLW transport routes to the NTS, also have CEMP stations.

The CEMP is a network of 26 stations, managed by DRI for the NNSA/NSO, located at ranches or in towns and cities around the NTS, used for monitoring of possible releases of radiation (Hartwell *et al*., 2001). Because the CEMP represents one of NNSA/NSO's major public outreach activities, particularly for rural communities near the NTS, DRI focused its cumulative exposure results on towns along transportation routes that host CEMP stations.

Table 1. Six major trucking routes used for transporting LLW to the NTS. Major towns along each route, including ones that host a CEMP station, are listed in parentheses.

Route Number	Direction	Color	DOE Transportation Route Codes
1	South (Shoshone, CA and Pahrump, NV [CEMP])	Yellow	01B, 01C, 01E, 02B, 02C, 02E, 02F, 03B, 03C, 03D, 03E, 04B, 04C, 04D, 05B, 05C, 05E, 06B, 06C, 06E, 10E
2	South (Shoshone, CA and Amargosa Valley, NV [CEMP])	Green	01D, 02D, 05D, 06D, 10C
3	North (out of Cedar City, UT) (Caliente, NV [CEMP])	Orange	12A, 12C
4	North (out of Reno, NV) (Tonopah, NV [CEMP])	Red	11B, 14A, 14B, 14C, 15A, 16A
5	North (out of Delta, UT) (Ely, NV [CEMP])	Yellow	09A
6	North (out of Idaho or Salt Lake City, UT) (Ely, NV [CEMP])	Blue	11A, 17A, 17B

Along the six routes, LLW trucks travel through five Nevada towns with CEMP stations (Figure 1). Route 1 travels through Pahrump; Route 2 travels through Amargosa Valley; Route 3 travels through Caliente (these trucks also travel through Cedar City, Utah, and Rachel, Nevada); Route 4 travels through Tonopah (and subsequently through Goldfield, Sarcobatus Flat, and Beatty); Route 5 travels through Ely and then Tonopah (these trucks also travel through Delta, Utah); and Route 6 travels through Ely and then Tonopah (these trucks arrive at Ely from routes to the north that pass through Salt Lake City and West Wendover, Utah). However, as indicated on Figure 2, only trucks traveling on Routes 1, 2, 5, and 6 used the PIC array during the study period. In Figure 3, the number of trucks that were measured at the PIC array passing through particular towns with CEMP stations is shown. The Tonopah total is cumulative, and includes those trucks counted in both the Ely and

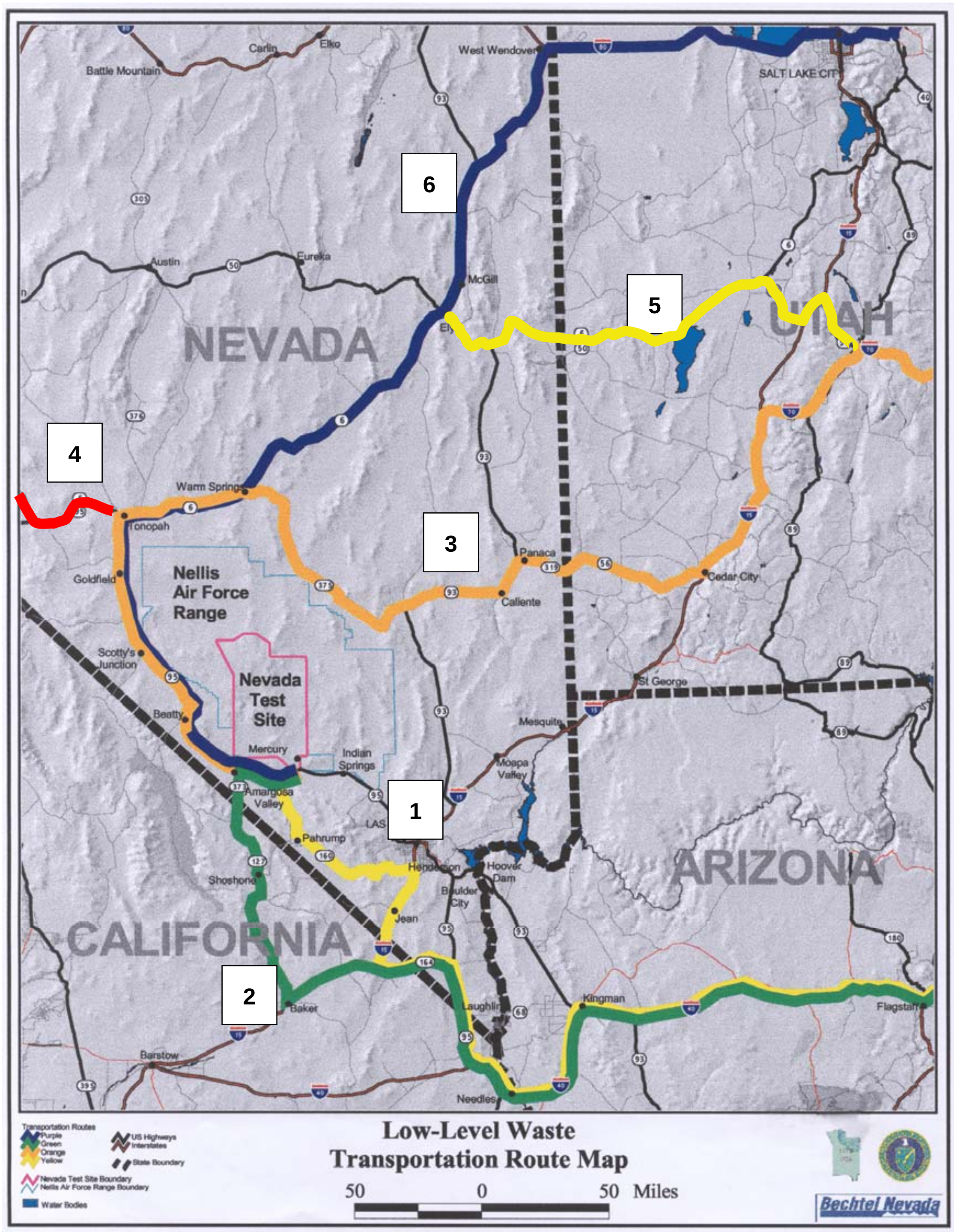

Figure 1. LLW transportation route map to the NTS. Las Vegas is located 105 km (65 mi) southeast of the entrance of the NTS near Mercury, where the PIC array was located.

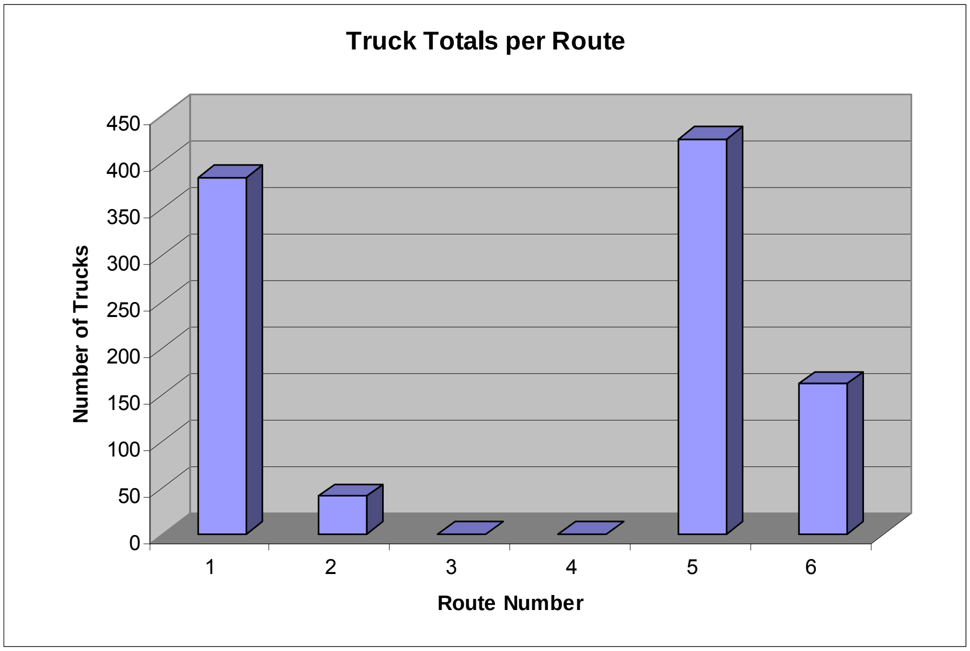

Figure 2. Bar graph of truck count per route.

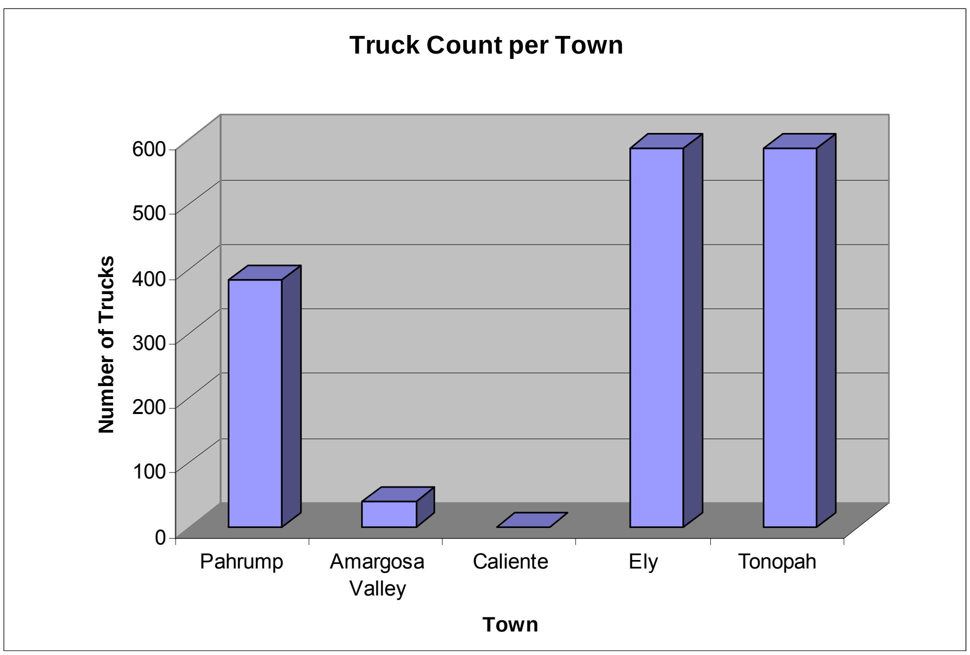

Figure 3. Bar graph of truck count per CEMP town. The Tonopah total includes those trucks counted in the Ely and Caliente totals, as well as trucks that intersect one of the major LLW transportation routes to the NTS at Tonopah. Gross counts for the routes were Pahrump (384 trucks), Amargosa Valley (42), Caliente (0), Ely (586), and Tonopah (586). Once a truck driver reached Ely, the only routes available to the NTS would take the truck through Tonopah as well.

Caliente totals, as well as trucks solely traveling through Tonopah (Route 4) on their way to the NTS. However, as there were no trucks traveling on Routes 3 or 4, the totals for Ely and Tonopah are identical. Although the CEMP stations are equipped with PICs for measuring total gamma radiation, which are the same instruments used for measuring external exposure from LLW trucks at the PIC array, the CEMP stations are not positioned along highway routes to collect data specific to potential exposure from LLW truck transportation.

In the past, there were no travel restrictions on LLW truck transport to the NTS, either through the Las Vegas Valley or across Hoover Dam. Between FY 1997 and the third quarter of FY 1999, a total of 1,216 out-of-state shipments arrived at the NTS, with a total of 916, or 75 percent, of these trucks crossing into Nevada via Hoover Dam and 100 percent of the shipments traveling through the main highway interchange of US 95 and Interstate-15 (the “Spaghetti Bowl”) in Las Vegas. However, former DOE Secretary Richardson made obligations to both the State of Nevada and the local governments within the Las Vegas Valley restricting these travel routes beginning in the fourth quarter of FY 1999. Trucks were no longer allowed to travel across the dam or through the valley, although a few drivers did still travel along these routes. During the fourth quarter of FY 1999 through FY 2001, only a few percent of the LLW trucks transporting to the NTS crossed Hoover Dam, and approximately 20 percent or less of the trucks traveled through the Spaghetti Bowl. After the events of September 11, 2001 (near the end of FY 2001), all truck travel across Hoover Dam was prohibited; thus, there have been no further LLW trucks crossing Hoover Dam. During this same time period, less than one percent of the LLW trucks have traveled through the Spaghetti Bowl or throughout the Las Vegas Valley along other routes.

METHODS

PIC Array

To measure exposure from LLW trucks, a stationary and automated array of four Reuter-Stokes (RS), Model RSS-131 High Pressure PICs was established at an existing roadside pullout along Mercury Highway just outside the main entrance to the NTS. The array was designed with two PICs on each side of the driveway, allowing a semi-truck to drive into the array and center the trailer between the two pairs of PICs (Figure 4, 5, and 6). As previously discussed, the PICs were positioned along the driveway so that they were 1.0 m (3.3 ft) away from the side of a standard truck trailer, at a height of 1.5 m (5.0 ft) to simulate the height of an adult citizen standing next to a LLW truck, and to be representative of the exposure of chest organs for a “Reference Man” using the Snyder-Fisher model of an adult human (Turner, 1995). The use of four PICs (two on each side) was to investigate for potential nonuniformity where gamma radiation levels from waste packages may vary from side to side, and from front to back in the truck trailer, depending upon packaging types and load arrangements. The PICs had a measurement range of approximately 2 μR/h to 800 μR/h.

Photoacoustic sensors (Campbell Scientific SR50 instruments) were positioned on each side of the driveway between the PICs, horizontally aimed at the center of the driveway, and were used to detect when a truck entered and departed the array. Data from both the PICs and photoacoustic sensors were recorded on time-calibrated Campbell Scientific CR10X dataloggers, which were then manually downloaded to a laptop computer. A drivers’ logbook was on-site for drivers to provide shipment identification information, and lights were provided at the PIC array so that it could be used 24 hours per day. Automating the array created an objective and consistent means to calculate the potential exposure from each truck.

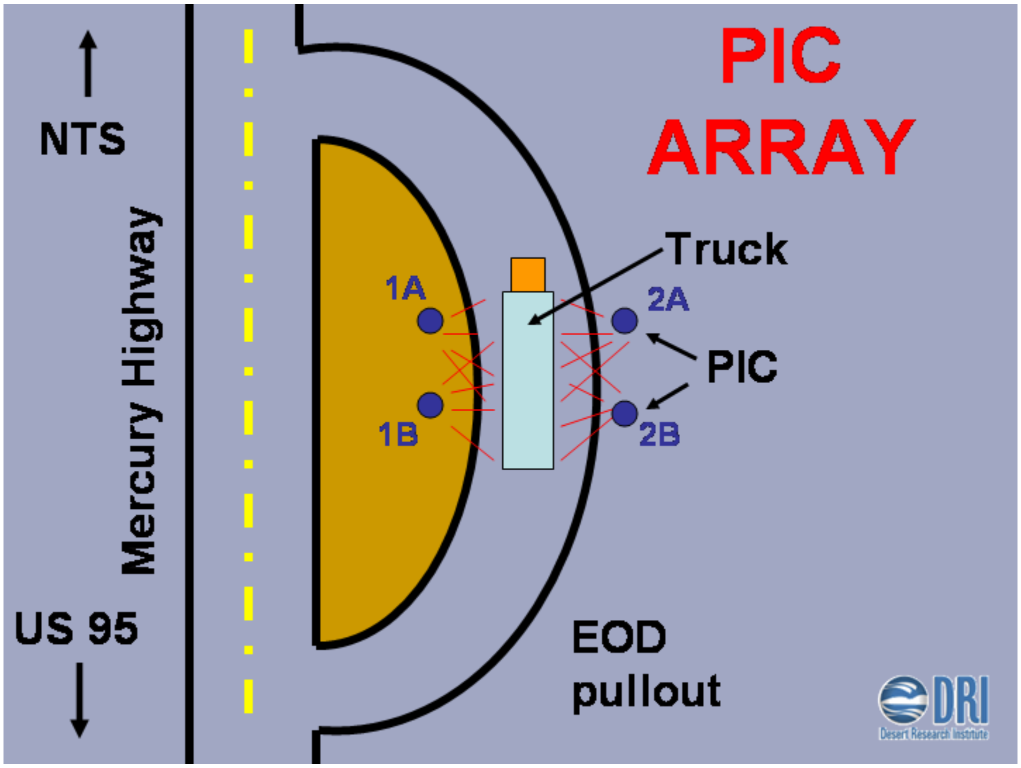

Figure 4. Plan view schematic of PIC array.

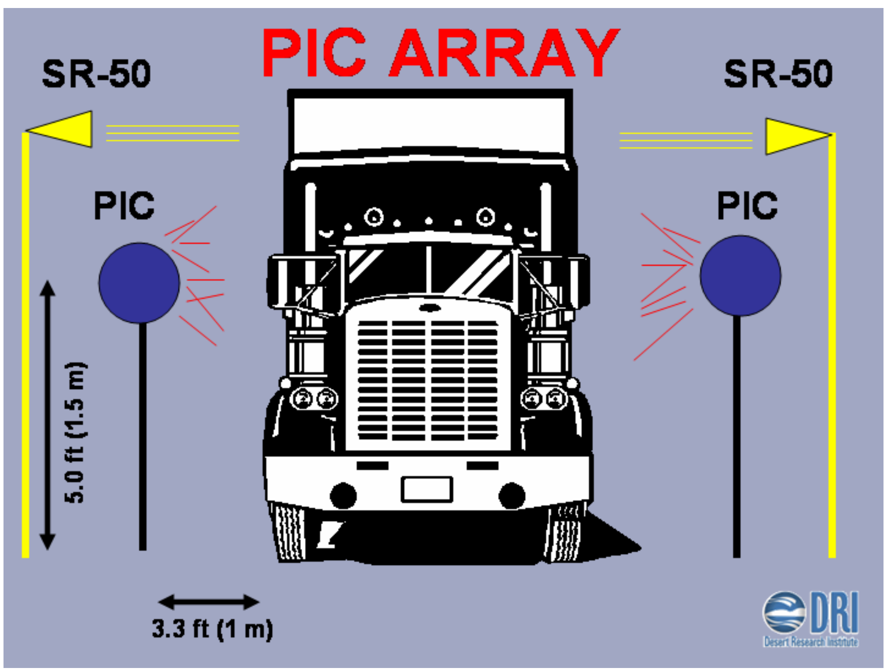

Figure 5. Front view schematic of PIC array.

Figure 6. A flatbed truck in the PIC array during the setup of the instrumentation.

Collecting and Processing Data from the PIC Array

The dataloggers were programmed to continuously run, with PIC measurements collected at 5-sec intervals. The dataloggers were programmed to analyze these data at 2-min intervals, and record, for each 2-min interval, (1) the maximum 5-sec μR/h value, (2) the minimum 5-sec μR/h value, and (3) the average of all 5-sec PIC readings. The photoacoustic sensors detected when a truck passed through the PIC array during a 2-min interval. It was assumed that it would take the driver longer than two minutes to enter the required information into the array logbook; however, particularly when the minimum recorded PIC value was at background, there was evidence that the truck may not have remained within the array for the entire 2-min period. In these cases, the 2-min averaged PIC readings would incorporate both measurements from the truck as well as background readings before or after the truck was in the array. As a consequence, the maximum PIC values were determined to be the most consistent and reliable measurements of an actual truck. Thus, the highest maximum value from the four PICs during a 2-min interval was selected as the gross measurement for the truck.

Collection of Background Data

Readings taken when trucks were not present in the array were used to calculate two background values in a 24-h period: from 1946 (7:46 pm) to 0744 h (7:44 am) and 0744 to 1946 h. For consistency in using maximum exposure measurements from the trucks, the average of the maximum background values obtained during the specific 12-h window when a truck arrived at the PIC array, and the standard deviation of the background values, were subtracted from the gross reading of the truck to obtain net exposure values for each truck.

Overall, background readings could vary from approximately 9 to 40 μR/h, although typically background readings ranged between 10 and 15 μR/h.

Instructions to Generators

To obtain the maximum population of radiological readings from trucks, the NNSA/NSO EM Program, in a letter to all approved offsite LLW generators, requested that all generator sites and their transportation companies participate in the study (DiSanza, 2002), assuming safe conditions for use of the PIC array site. For example, the pullout that was used was long enough that several trucks could be safely pulled off the highway at one time to wait their turn to go through the PIC array. However, the drivers were instructed to bypass the array if so many waiting trucks parked in the driveway created a backup along the driveway, causing drivers to stop their trucks along the shoulder of Mercury Highway. For safety reasons, the county sheriff would not allow trucks to be parked along the shoulder of the roadway leading to the main entrance gate at the NTS.

When a driver entered the array, he or she parked the truck trailer in a marked "footprint" within the array and then entered information into a logbook located at the site. The drivers were asked to record several key pieces of information about their waste shipment, including date and time of arrival, Waste Shipment Identification Number (WSIN) and final destination on the NTS (Area 3 RWMS or Area 5 RWMC, if known).

Calibration of the PIC Array

The objective in calibrating the PIC array was to examine the response of the PICs to a known source strength in the same array configuration used to study the potential radiation exposure of an LLW truck. The measurements could then be compared to the theoretical response versus distance (i.e., inverse-square law) curve and values calculated for the calibration source when the distance between the source and the PIC was increased. The PICs were permanently installed at the vehicle pullout area and positioned so that approximately one-third of the truck trailer extended beyond the front and back of the PIC array (Figure 3). An Isotope Products Laboratories 189.2 μCi source of ^{137}Cs (Nevada State Health Division, Radioactive Material License Number 16-13-0003-07) was mounted on a tripod within a Plexiglas® framework, selected to reduce or minimize absorption and scatter of the ^{137}Cs gamma rays. A laser-light level was used to verify that the source was in the same horizontal and vertical planes as the center point of the PIC ionization chamber for each distance where PIC responses were measured.

The exposure rate was measured at three different distances between the source and the center of the PIC ionization chamber: 0.3 m (1.0 ft), 0.5 m (1.6 ft), and 1.0 m (3.3 ft) (see Table 2). Gross or total gamma readings in μR/h were taken every 5 sec for a total of seven measurements at each distance. From the average value of the total gamma measurements, an average background reading (seven measurements total) was subtracted to yield a net value. The exposure and background rates, displayed on the screen of a connected laptop computer, were both hand recorded and digitally recorded on a connected datalogger, which was then downloaded to the laptop computer. Work was temporarily halted if winds at the site exceeded approximately 16 to 24 km/h (10 to 15 mph).

Table 2. Results of field calibration of the PICs in the array, as well as laboratory calibrations at DRI. Background readings were subtracted from gross readings of the PICs to obtain net readings in μR/h. Parenthetical values below the three distances from the source at which PIC readings were taken (100.0, 50.0, and 30.0 cm [39.4, 19.7, and 11.8 in]) are theoretical values for the source (189.2 μCi ^{137}Cs) used for calibration using the Inverse Square Law.

Field Calibration					
		Net Readings (μR/h)			
Distance (Theoretical Value)		100 cm (60.5)	50 cm (242.0)	30 cm (672.7)	Background (μR/h)
Datalogger 1	PIC 1A	62.7	243.0	672.0	11.7
	PIC 1B	62.3	245.0	664.0	11.7
Datalogger 2	PIC 2A	57.4	225.0	614.0	11.1
	PIC 2B	61.5	235.0	654.0	11.6
DRI Laboratory Calibration					
		Net Readings (μR/h)			
Distance (Theoretical Value)		100 cm (60.5)	50 cm (242.0)	30 cm (672.7)	Background (μR/h)
Datalogger 1	PIC 1A	63.6	244.8	671.4	10.6
	PIC 1B	63.8	--	--	10.9
Datalogger 2	PIC 2A	59.0	228.7	622.7	10.6
	PIC 2B	61.9	--	--	10.3

Following completion of the data collection phase in the field, the array was disassembled and the PICs brought back to the DRI laboratory in Las Vegas, Nevada. A similar calibration was performed on the PICs in the laboratory to compare against the measurements taken in the field. For PIC 1A and PIC 2A, a total of 15 measurements were taken in the laboratory at each of the same three distances measured in the field (0.3 m [1.0 ft], 0.5 m [1.6 ft], and 1.0 m [3.3 ft]) and net values calculated similar to the field calibration. Data were collected for PIC 1A for all three distances because they were also sent to the U.S. Department of Homeland Security's Environmental Measurement Laboratory (EML) for an independent cross-calibration check to verify quality assurance of the array. The measurements were performed in the laboratory for ease of comparison with the EML cross-calibration data. Exposure rate readings for PIC 2A were repeated at all three distances because PIC 2A showed a slight under-response to the source in the field. This under-response was also measured in the laboratory. For PIC 1B and PIC 2B, sets of measurements were taken only at a single distance of 1.0 m (3.3 ft) since these PICs were not being sent to EML for cross calibration.

The following equations were used for calculating the measured exposure rate for each PIC and the theoretical or expected values versus distance using the Inverse Square Law for point sources of gamma radiation.

Exposure Rate (gamma ray point source):

$$\text{mR/h} = \frac{n\,I_y}{d^2} \qquad (1)$$

where: n = number of millicuries (mCi)

$I\gamma$ = mR/h at 1.0 m (3.3 ft) per mCi or 0.32 for ^{137}Cs NCRP, (NCRP, 1974)

d = distance (m)

Solving for 189.2 μCi or 0.1892 mCi of ^{137}Cs (source):

$$\mu\text{R/h} = \frac{[(0.1892)(0.32)]}{1m^2} = 60.5\ \mu\text{R/hr}$$

Equation for Inverse Square Law (for point sources of gamma radiation):

$$\frac{I_1}{I_2} = \frac{(R_2)^2}{(R_1)^2}\ or\ I_2 = I_1 \times \frac{(R_1)^2}{(R_2)^2} \qquad (2)$$

where: I_1 = radiation intensity at distance R_1 from the source.

I_2 = radiation intensity at distance R_2 from the source.

In addition to the field calibration against a known source, direct measurements of the voltage supply using serial communication cables and software from RS was conducted. There was only a 0.4 percent difference in the solid-state voltage outputs between the highest and lowest values for all four PICs (Table 3).

Table 3. Solid-state voltage outputs for the PICs.

PIC	Volts of direct current (vdc)
PIC 1A	399.6
PIC 1B	401.2
PIC 2A	400.4
PIC 2B	401.3

As a final quality control check, PIC 1A was sent to the EML for an independent laboratory calibration. A 1-mg, National Institute of Standards and Technology-traceable ^{266}Ra needle source was used in a shadow field geometry at a distance between 4 and 5 m from the PIC. At this distance, the exposure rate for the direct beam ranged from 30 to 45 μR/h. The result for the direct analog output from PIC 1A was 14.1 mV per μR/h. This calibration factor provided a room background reading of about 7 μR/h. PIC 1A was previously calibrated by RS in March 2001 with a ^{137}Cs source and gave a value of

13.68 mV per µR/h, a 3 percent difference from the EML reading, but well within the tolerance range for energy response variance for a PIC, particularly when different sources are used for calibration (Shebell, 2004).

Data Collection, Management, and Analysis

During the course of the data collection period, PIC and photoacoustic measurements were periodically downloaded via a laptop computer from the dataloggers at the PIC array into a Microsoft Excel spreadsheet. However, for the analysis of the data for potential exposure values, a Microsoft Access database was developed. A sample of the database for a truck with PIC-detected, above-background exposure readings is shown in Table 4. As discussed previously, the dataloggers ran continuously and export of the gamma readings were recorded in military time. The conversion to Julian time was made in the Microsoft Access database. Plotting of gamma readings as a function of time graphically was another means of identifying a truck in the PIC array (Figure 7).

Table 4. Sample Microsoft Access database format for LLW truck transportation exposure data collected on dataloggers at the PIC array. The data are for PIC 1A when a LLW shipment went through the array. The shipment identification number was recorded by the driver in the logbook, although the actual number shown in this table is fictitious. The approximately 2-min period when the truck was detectable in the PIC array is highlighted in gray. The maximum PIC readings in µR/h of 47.87 and 59.35 are in excess of PIC readings preceding and following the truck, which represent background readings. Days are in Julian Days starting in January 2003. Time is recorded in military time. In this case, the truck went through the PIC array between 12 noon and 12:30 P.M. on March 2, 2003.

Shipment ID	Validated ID	Notes	J-Day	Time	PICA Avg µR/hr	PICA Min µR/hr	PICA Min Time	PICA Max µR/hr	PICA Max Time
			61	1210	11.33	9.53	1208	14.17	1209
			61	1212	11.16	9.77	1210	12.70	1211
			61	1214	11.36	9.28	1212	15.63	1213
			61	1216	10.91	10.01	1214	12.70	1215
NTS12345	NTS12345	OK	61	1218	33.96	9.77	1216	47.87	1217
			61	1220	42.85	11.23	1220	59.35	1219
			61	1222	11.40	10.26	1221	12.94	1220
			61	1224	11.19	9.53	1222	12.94	1222
			61	1226	11.18	9.53	1225	13.68	1225
			61	1228	11.37	10.01	1227	12.70	1227

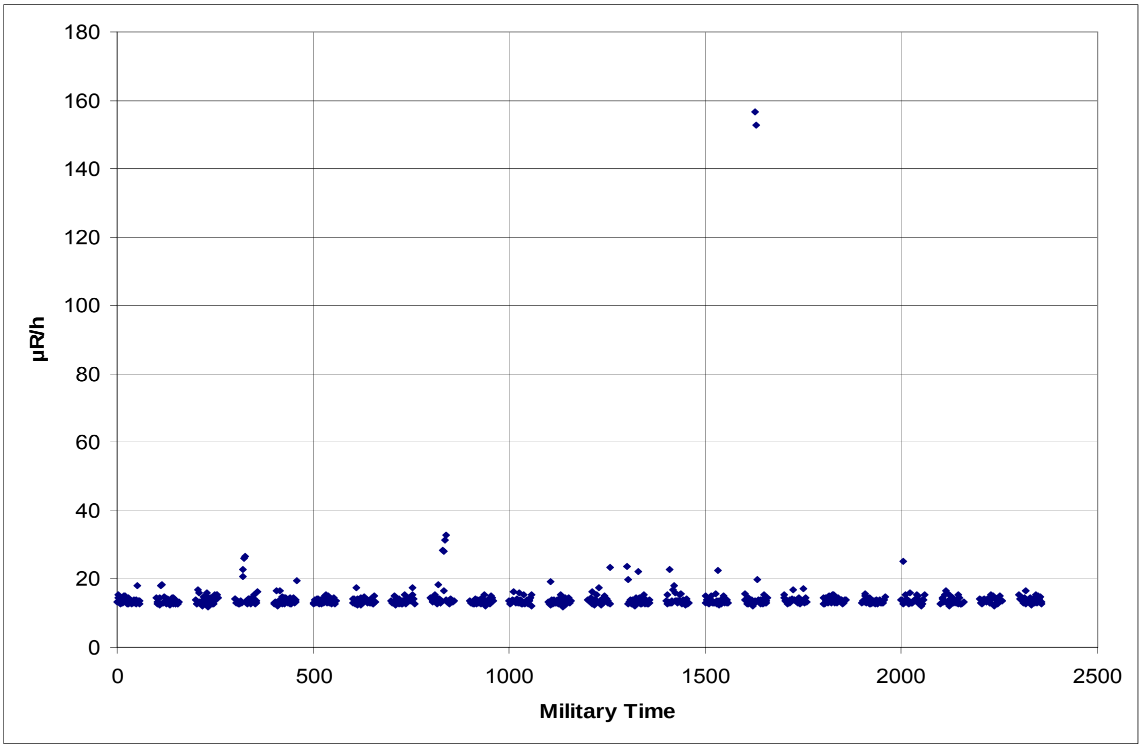

Figure 7. Maximum readings from PIC 2B on May 5, 2003, plotted as a function of military time. Readings between approximately 10 and 35 µR/h represent readings of maximum background during 2-min intervals. Two higher readings between approximately 150 and 160 µR/h at about 1600 h is a truck in the PIC array.

The most significant information provided by the drivers in the logbook was the WSIN, which allowed PIC readings from the truck to be compared to information on the waste manifest sheets collected at the Area 5 RWMC and Area 3 RWMS. Thus, having the WSIN for each truck facilitated comparison of truck readings collected at the PICs to waste type and inventory, generator, radiation readings collected at the Area 5 RWMC and Area 3 RWMS, and transportation route information.

Criteria for Identifying a Truck in the PIC Array

The LLW transportation database was date/time justified for those instruments tied to dataloggers including the PICs and the photoacoustic sensors. Ideally, a truck could be added to the database because the following events were observed or recorded:

- The SR50 and SR50 Q data indicated the presence of an "object" (presumably a truck based upon sensor height) between 1.5 and 1.9 m (4.9 and 6.2 ft) distance from the sensors.
- The truck driver recorded his or her arrival in the logbook at a time consistent with the SR50 and SR50 Q recorded time.
- The WSIN was also recorded in the logbook.

- Finally, for the trucks with a gross exposure measurement above background, one or more of the PICs recorded a gamma reading that was higher than preceding PIC measurements, which would represent background readings. However, especially for trucks with an external exposure at or only slightly above background, PIC readings alone, with no other supporting data, were insufficient evidence of a truck.

Some of the data recorded by the truck drivers, however, were incorrect or incomplete. Common problems encountered, but that could be corrected, included the following:

1. The driver recorded the wrong date.
2. The driver recorded the wrong time, or the time that was recorded was correct for the time zone where he or she began her trip to the NTS. In some cases, no time of arrival at the PIC array was recorded, although information on the truck was otherwise written down.
3. The origin of the waste was not recorded, or the wrong code was used for the site of origin.

A correctly recorded WSIN was the most valuable quality assurance data for correcting the database. When errors or omissions were made by the drivers in the logbook, the WSIN was compared with the waste manifest records maintained at the Area 5 RWMC, which previously had been copied and collected for comparison with the PIC database, and were used to ascertain the correct information. The waste manifests also served as a secondary check of a truck that was measured as "above background" in terms of the gamma radiation field at the PIC array because they frequently were recorded as "above background" at the Area 5 RWMC or Area 3 RWMS based on near-contact gamma radiation measurements made with portable, hand-held instruments. Finally, because the datalogger provided a continuous record of the PICs and the photoacoustic sensors, a truck whose arrival time was incorrectly recorded was still represented within the database as the next truck that used the PIC array. Thus, simply knowing the sequence of trucks that used the array was sometimes enough to correct the database. In the case of the wrong generator code being logged in, if the remainder of the WSIN was correctly recorded, then the site generator code could be corrected.

An unanticipated situation was trucks traveling in a convoy and going through the PIC array as a group with virtually no break in time between each truck. This typically occurred in the morning before the entrance to the NTS was opened. As an example, four truck drivers signed the logbook as the first truck sat in the array, and then all drove their vehicles straight through without stopping, rather than each driver individually parking the truck in the array while he or she recorded information in the logbook. The convoy situation created data records where the response time of the instruments was not fast enough to distinguish each vehicle. In such cases, the numbers of unique readings that could be identified were recorded for an appropriate number of trucks, but the remainder were also recorded as "nti" (no truck identified). An overall assumption was that only LLW trucks were driven through the PIC array.

Nevertheless, as previously mentioned, there is a subpopulation of measurements that may represent trucks passing through the PIC array. The best evidence of this was a combination of photoacoustic sensors recording the presence of an object and, in some of these same cases, one or more of the PICs recorded readings clearly exceeding the background readings preceding the event. In these cases, an nti was recorded, and the date and time were noted in the database. Because there were episodes of increased gamma radiation readings unrelated to a truck, simply having an episode of higher gamma readings was insufficient evidence of a LLW truck. The nti records were retained in a separate database. However, they were not included among the 1,012 trucks in the database and their apparent net exposure values were not used to calculate background nor the standard deviation for the 12-h periods when recorded trucks used the PIC array. In addition, PIC readings during periods when the array was calibrated were removed when background values were calculated.

Truck Exposure Readings Greater than 800 µR/h

A problem not discovered until after data collection was well underway, was the performance of the PICs for trucks with gross exposure readings exceeding 800 µR/h. Although manufacturer specifications for the Reuter-Stokes, Model RSS-131, PIC used in this study stated that the instrument would read to 1,000 µR/h, it was subsequently found that a second channel on the PIC had to be used for measurements over 800 µR/h, and even then, pursuant to the manufacturer, the “analog sensitivity output is invalid” for measurements between 800 and 1,000 µR/h (Reuter-Stokes, 2001). Of the 1,012 trucks measured, 59 had gross gamma readings at the PIC array greater than 800 µR/h.

To rectify this situation, when a record of 800 µR/h or greater occurred, the WSIN from the truckers’ logbook was used to find the specific waste manifest sheet from the RWMC or RWMS records. As previously discussed, the waste manifest sheets include the hand-held radiation instrument readings made by the LLW radiological control technicians (RCT) at the RWMC and RWMS. The RCTs routinely record onto the waste manifest sheets the gamma radiation measurements of the highest readings at the surface of the truck trailer, at 0.3 m (1.0 ft) distance from the trailer, at 1.0 m (3.3 ft) distance from the trailer, and at the truck cab, approximately 3 m (10 ft) distance from the trailer. The radiation readings are made using a Ludlum Model 3, hand-held gamma detector. In all, data from 77 trucks, including the 59 recorded at the PIC array, with gross measurements greater than 800 µR/h, were examined to evaluate whether the 1.0 m (3.3 ft) measurements at the Area 3 RWMS and the Area 5 RWMC could be substituted for the greater than 800 µR/h at the PIC array.

One concern was whether the measurements of individual trucks at the RWMC were unduly influenced by neighboring trucks, thereby artificially increasing the gross gamma measurements made by the RCTs. In examining the radiation readings for each of the trucks at the cab, a distance of 3 m (10.0 ft) from the truck trailer, 73 of the 77 trucks (94.8 percent) had readings indistinguishable from background, typically 50 µR/h at the disposal site (Gertz, 2001). Four trucks had measurements above the disposal site background value at the cab. However, these four trucks also had the highest “on contact” readings of the population of 77 trucks, and as expected, had the highest readings at the cab. However, the preponderance of cab readings for the 77 trucks that were below background suggests that the hand-held readings were not artificially increased by adjacent trucks. Also, as the waste inventories of each shipment were already known at the disposal site prior to the truck’s arrival, any truck that would have radiation readings above background was immediately segregated from the other trucks, and parked in an isolated part of the parking lot. Another check of consistency between measurements taken at the PIC array and measurements taken at the RWMC was that, in all but one case, trucks measured at the PIC array that produced gross exposure values exceeding 800 μR/h also produced values at the RWMC that exceeded 800 μR/h at a distance of 1.0 m (3.3 ft). In the one exception, the RWMC reading was 750 μR/hr.

However, before using the 1.0-m (3.3-ft) readings made by the RCTs in place of the greater than 800 μR/h reading at the PIC array, the collective relationship of the truck readings to one another was examined to establish whether the readings made with the hand-held instruments could be used to predict exposure readings comparable to the readings made at the PIC array. To investigate this, each truck's hand-held readings at 0.3 m (1.0 ft) and 1.0 m (3.3 ft) were normalized to their own surface contact readings. The distances were first corrected for the typical thickness of the sidewall of a van-type truck trailer, 0.022 m (0.07 ft). As such, the Ludlum Model 3 readings were plotted such that the contact reading was 0.022 m (0.072 ft), and subsequent readings at increasing distances were corrected to 0.322 m and 1.022 m (1.07 and 3.35 ft). The data were then evaluated to see if the slope of the resulting curve (gross gamma reading versus distance) and its standard deviation would suggest that the data behaved in a manner such that readings at 1.0 m (3.3 ft) were predictable.

Figure 8a illustrates the slope of the average ratio. The trend line was derived with a least-square fit using the following equation: $y=cx^b$ where *c* and *b* are constants. The standard deviation for the 0.322-m (1.07-ft) point is ± 17 percent, while the 1.022-m (3.35-ft) point is ± 35 percent. The slope of the line ranged from -0.17 to -0.35, with a value of -0.24 for the mean. Measurements made with the hand-held instruments at the Area 5 RWMC at 1.0 m (3.3 ft) were ± 35 percent. It was the judgment of the authors that the 35 percent standard deviation of the 1.0-m (3.3-ft) measurements at the RWMC did not preclude the RWMC data from being used in the transportation exposure database for the trucks whose gross reading exceeded 800 μR/h at the PIC array. There were five trucks at the PIC array for which at least one PIC measurement exceeded 800 μR/h, but for which survey information from the RWMC on the NTS could not be obtained. However, as these trucks were all from the same generator, the average normalized gross exposure from other trucks of this generator with PIC measurements exceeding 800 μR/h was used for these trucks.

Reduction in Radiation Intensity as a Function of Distance from LLW Trucks

Another benefit of examining the Ludlum Model 3 readings collected at the Area 5 RWMC was to examine the rate at which radiation intensity readings decreased as a function of increasing distance away from the 77 trucks examined with readings exceeding 800 μR/h. In previous studies of LLW truck transportation to the NTS, trucks have been treated both as a point source (Gertz, 2001) and as a line source (Davis *et al.*, 2002). However, as illustrated in a comparison of Figures 8a, 8b, and 8c, the rate of decrease with distance may be much lower or "slower" than would be predicted by assuming either a point or a line source.

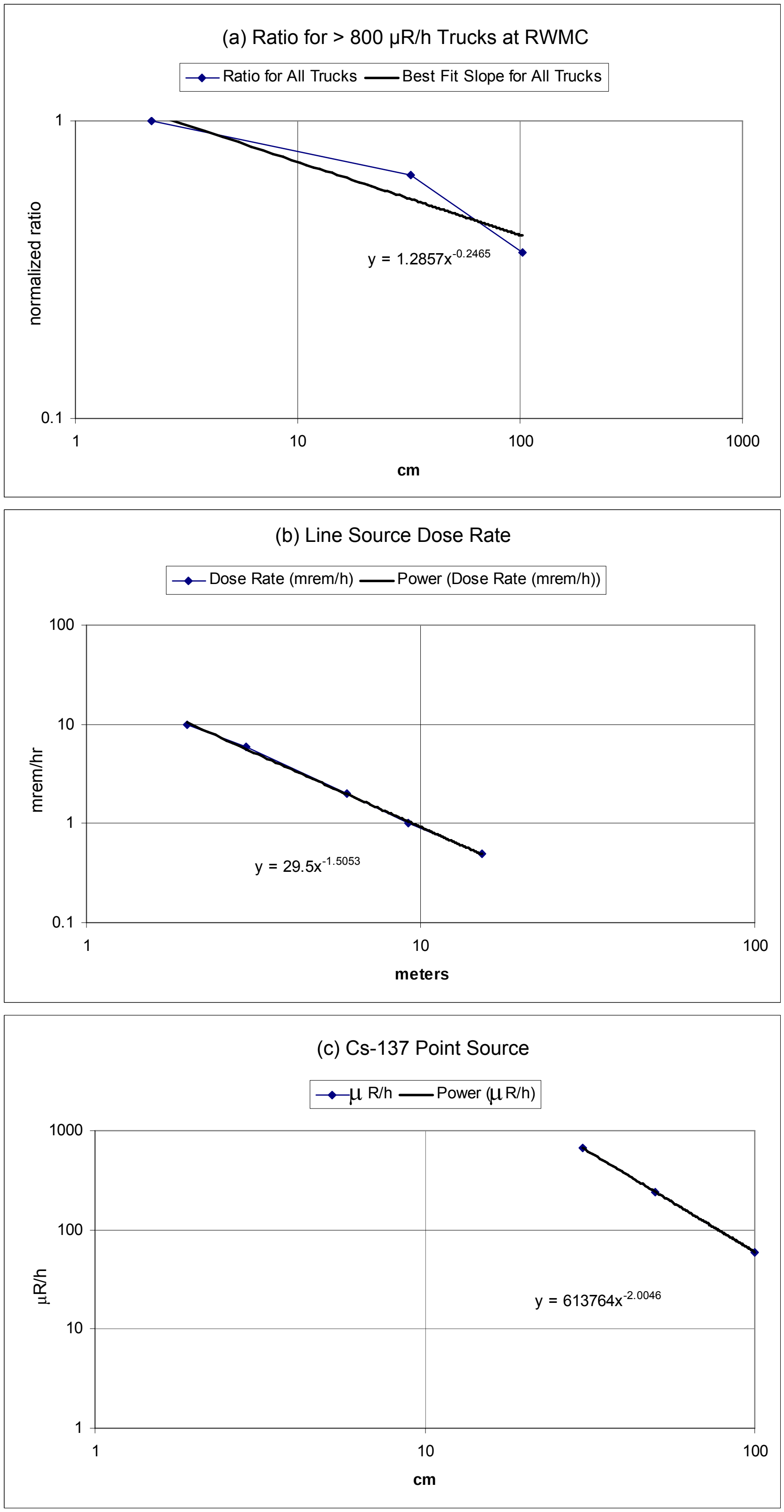

Figure 8. Rates of radiation intensity reduction as a function of increasing distance.

In Figure 8a, the slope is based on the normalized ratios of gross gamma readings at 0.022, 0.322, and 1.022 m (0.07, 1.07, and 3.35 ft) for the 77 trucks with readings exceeding 800 μR/h. In Figure 8b, for a line source, the following equation would be used to calculate the slope: $m=\log(y_2/y_1)/\log(x_2/x_1)$. Data are from Davis *et al.* (2002). In Figure 8c, data from Shebell (2004) are used to calculate the slope, "m", for a point source in log-log space, using the power function equation of $y=a/x^m$. The slopes of the resulting curves indicate significant differences. For the 77 trucks examined from the RWMC, the average slope is -0.24 (Figure 8a). For the line source, the slope is -1.5 (Figure 8b), while for the point source, the slope of the curve is -2.0 (Figure 8c). For example, if the three equations (normalized, line source, and point source) were used to predict the radiation exposure values at 2.0 m (6.6 ft) when the exposure value is known to be 10 mR/h at 1.0 m (3.3 ft), the resulting values would be 7.5, 3.5, and 2.5 mR/h, respectively. In summary, the slope from the observed, normalized truck value ratios at the Area 5 RWMC was considerably slower than if the same trucks were treated as line or point sources.

There may be good reasons why the LLW trucks examined are not behaving similar to point or line sources. The LLW shipments to the NTS are configured with packages that are most likely randomly arranged within the trailer with regard to heterogeneity of waste forms and radioactive content, as well as total radioactivity of containers. In fact, it was for this reason that the PIC array was designed with four PICs rather than relying on a single PIC measurement. The authors could find no references describing the observed phenomena for LLW shipments. Further examination of this issue is discussed in the recommendations section of this report.

Calculation of Net Exposures for a Truck

As discussed previously, background radiation measurements were continually measured by the PICs when trucks were not parked within the array. For each 2-min period, the datalogger recorded the maximum reading from each PIC, the average value, and minimum value. An "average" background for a given period of time (e.g., 12 h) was calculated by taking the average of the 2-min averages for that period. Thus, two daily 12-h time periods were selected to determine background values, representing "daytime" (0746 to 1944 h [7:46 am to 7:44 pm]) and "nighttime" (1946 to 0744 h [7:46 pm to 7:44 am]), for any diurnal changes in background values. For each 12-h time frame, the average readings from the PICs were totaled, divided by the total number of readings (usually 360 readings for each 12 h), and an average background value for that specific 12-h period was determined. If within any 12-h period LLW trucks were responsible for any of the 2-min values, the database queries for background were modified to reject those specific records so they did not contribute to the total background readings for the 12-h period. Thus, if a single truck was in the array during a specific 12-h period, and the database records showed that it was there for one PIC reading cycle, then that average PIC reading record was not included in the total of all average PIC readings, and the total number of readings was reduced to 359. Thus, the waste inventory within that truck was not allowed to skew the calculated background readings. Last, for each 12-h period, a standard deviation of the average background readings was calculated.

To avoid any perception of biasing a potential exposure low, the maximum PIC reading from the array (i.e., the single highest reading of the four PICs) for each truck measurement was assigned as the maximum gross radiation value for each truck. To calculate the "net exposure" for each truck, the average of the maximum background values during the corresponding 12-h period when the truck arrived at the PIC array, as well as the absolute value of the standard deviation of the background reading, was subtracted from the maximum gross exposure measurement of the truck recorded (see Appendix). If, after subtracting the background and standard deviation from the gross radiation exposure value of the truck, the net exposure was equal to or less than zero, then the truck was considered as having no potential exposure above background, and was assigned a net exposure value of "zero." For the 59 trucks whose gross exposure measurements exceed 800 μR/h, the background and standard deviation for when the truck went through the PIC array was used instead of the standard 50-μR/h background with no standard deviation that is used at the Area 5 RWMC.

In calculating background, values from three of the four PICs were used. The exception was PIC 1B, as there were episodes during the study period when transmission from this PIC was interrupted. Because there was some uncertainty about the duration of these events, its background readings were not incorporated with those of the other PICs.

Table 5. The net exposure results for a subset of trucks that passed through the PIC array between July 1 and July 8, 2003. For these net exposure calculations, the average of the 2-min PIC array maximum background measurements, and its standard deviation, taken during the 12-h period during which each truck arrived, was subtracted from the gross value measured when the truck was within the array. A net exposure value of zero or less than zero was assigned as "zero." The "Sequence Number" is only for ease in using this table and does not correspond to the Sequence Number for the entire truck data set in Appendix. See Figure 1 for route numbers.

Sequence Number	Date	Time of Shipment	Gross Value	Maximum Background	Standard Deviation	Net Exposure	Route Number
1	July 1, 2003	10:20:00 PM	15.08	13.76	1.43	-0.12	1
2	July 2, 2003	1:20:00 AM	15.08	13.76	1.43	-0.12	1
3	July 2, 2003	4:20:00 AM	15.09	13.76	1.43	-0.11	5
4	July 2, 2003	6:00:00 AM	14.85	13.76	1.43	-0.35	5
5	July 2, 2003	6:04:00 AM	14.85	13.76	1.43	-0.35	5
6	July 2, 2003	6:06:00 AM	15.63	13.76	1.43	0.43	5
7	July 6, 2003	8:26:00 PM	15.37	13.94	1.23	0.21	1
8	July 6, 2003	11:32:00 PM	15.08	13.94	1.23	-0.08	2
9	July 6, 2003	11:34:00 PM	16.56	13.94	1.23	1.40	1
10	July 6, 2003	11:36:00 PM	15.32	13.94	1.23	0.16	1
11	July 7, 2003	12:18:00 AM	14.84	13.94	1.23	-0.32	1
12	July 7, 2003	12:20:00 AM	15.08	13.94	1.23	-0.08	1
13	July 7, 2003	7:00:00 AM	17.33	13.94	1.23	2.17	5
14	July 7, 2003	5:34:00 PM	14.64	13.98	1.37	-0.71	5
15	July 7, 2003	8:06:00 PM	15.51	13.82	1.16	0.53	5
16	July 7, 2003	9:30:00 PM	15.56	13.82	1.16	0.58	5
17	July 8, 2003	12:30:00 AM	15.32	13.82	1.16	0.34	1
18	July 8, 2003	12:32:00 AM	15.08	13.82	1.16	0.10	1
19	July 8, 2003	5:24:00 AM	14.84	13.82	1.16	-0.14	5
20	July 8, 2003	6:04:00 AM	14.85	13.82	1.16	-0.13	5
21	July 8, 2003	6:30:00 AM	14.85	13.82	1.16	-0.13	5

RESULTS

Measurement Frequency

For the 1,012 trucks, net exposure rates at 1 m (3.3 ft), either derived from gross measurements from the PIC array or from hand-held measurements for trucks with gross readings greater than 800 μR/h, range from -6.65 to 11,970 μR/h (11.9 mR/h) (Appendix). For nearly half of the trucks measured (483 or 47.7 percent), net exposure values were equal to or less than zero, indicating that the measurement at the PIC array was indistinguishable from background (Figure 9 and Table 6). Consequently, these trucks represented no potential net exposure to the public. Any net exposure value of less than zero was subsequently set to zero in the database ("Adjusted Exposure" column in Appendix) for cumulative exposure calculations. An additional 206 trucks (20.4 percent) had net exposure values ranging between 0 and 1 μR/h. Thus, a total of 689 trucks (68.1 percent) had values less than or equal to 1 μR/h. The nonGaussian nature of the dataset is evident in Figure 9 and in Table 6. It is also evident in cumulative exposure measurements that are dominated by the small number of trucks (e.g., the 59 trucks) above 800 μR/hr.

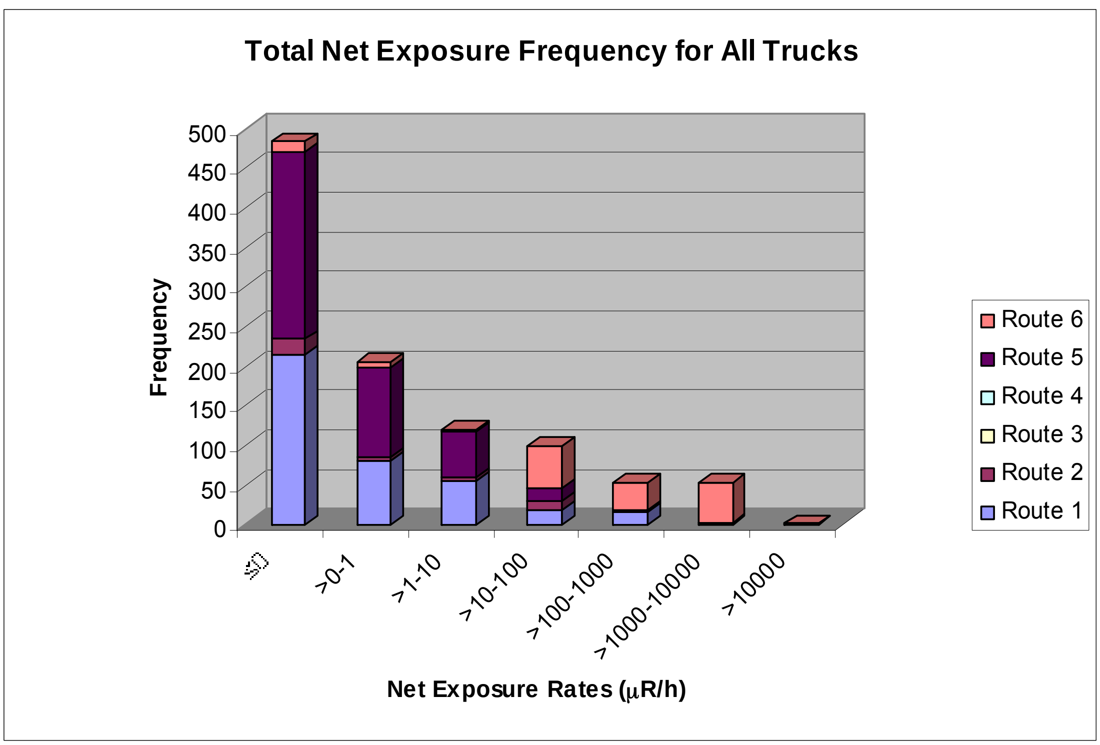

Figure 9. Net exposure measurement frequency for all 1,012 trucks measured during the study using the average background and standard deviation. The absolute number of trucks per increment of exposure measured at the PIC array and RWMC is shown in Table 6.

Table 6. The absolute number of trucks per increment of net exposure.

Net Exposure Range in μR/h	Total Number of Trucks	Number of Trucks on Route 1	Number of Trucks on Route 2	Number of Trucks on Route 5	Number of Trucks on Route 6	Number of Trucks on Route 5/6
≤ 0	483	215	19	237	12	249
>0-1	206	80	6	113	7	120
>1-10	120	56	3	58	3	61
>10-100	94	18	12	15	53	68
>100-1,000	55	15	1	2	35	37
>1,000-10,000	53	0	0	2	51	53
>10,000	1	0	0	0	1	1
TOTAL	1,012	384	41	427	162	589

While there are some trucks in the database (e.g., the 59 trucks greater than 800 μR/h) with *comparatively* high readings, the potential net exposure values for all 1,012 trucks are far below any regulatory limits. There are no standards *per se* for potential exposure from LLW shipments at 1.0 m (3.3 ft). However, as previously discussed, DOT has a shipping standard at 2.0 m (6.6 ft) distance of 10 mrem/h (10,000 μR/h). Assuming a one-to-one correspondence between Roentgens and Rems (Shleien *et al*., 1998), then 903 trucks (89.2 percent of the trucks measured) were no greater than one percent of the DOT standard at 1.0 m (3.3 ft). Had the distance at which the trucks been measured increased to 2.0 m (6.6 ft), the net exposure would be even less because of the increase in distance between the truck and the receptor. However, based on the empirical data from this study for trucks with gross measurement reading greater than 800 μR/h, the rate of decrease may be slower than for either a point or line source. The highest adjusted net value, 11.9 mR/h, came from the only truck with a value greater than 10 mR/hr.

Potential Cumulative Exposure Scenarios

To address a concern of some stakeholders in rural communities along transportation routes of cumulative exposure, several cumulative exposure scenarios were developed for members of the public. Some scenarios assumed trucks were traveling at slower speeds through rural towns and were required to stop at a light or stop sign along the roadway. Also, scenarios were developed for situations in which the truck driver parked his or her vehicle for various periods of time. Exposure scenarios are described in Table 6. It should be noted that the cumulative exposure scenarios represent the highly unlikely case that the same individual would be in proximity to each of the LLW trucks that traveled through particular towns along the LLW transportation routes; however, the exposure scenarios were developed to apply to the aforementioned "reference man." As a point of comparison, the cumulative exposure values are compared to the ICRP and 10CFR834 Subpart B public dose limit of 100 mrem/y from a licensed facility, assuming a one-to-one correspondence between Roentgens and Rems (Shleien *et al*., 1998).

One of the concerns of stakeholders in rural communities along transportation routes is incremental exposure from the passage of LLW trucks along "Main Street." That is, when the transportation route and the main road in the town are the same, the potential of a person being exposed to LLW truck shipments at a distance of 1.0 m (3.3 ft) is increased. The exposure scenarios (Table 7) were developed to address issues of cumulative potential exposure. Total exposure of the individual in any of the scenarios is determined by the product of the quantity of the potential exposure time (h), the net exposure rate (μR/h), summed for all the trucks an individual is exposed to (net being the difference between the maximum PIC reading for the truck and the appropriate background value and standard deviation measured by the PICs), and the distance between the trailer and the individual.

Table 7. Potential exposure scenarios for members of the public in rural towns in Nevada and Utah along transportation routes to the NTS.

Scenario Number	Scenario	Distance	Potential Exposure Time
1	A truck travels slowly through town, past an individual (“Reference Man” - Davis *et al*., [2002]) standing on the sidewalk.	1.0 m	15 sec
2	An individual is parked at a stoplight, adjacent to a LLW truck trailer.	1.0 m	1 min
3	The driver stops for fuel, with an attendant dispensing fuel.	1.0 m	0.5 hr
4	The driver stops for a meal, parking along the curb.	1.0 m	1 hr
5	The truck driver stops at a roadside rest area to sleep overnight.	1.0 m*	8 hrs

* No credit is given for shielding provided by the second vehicle where the reference man is located.

Total cumulative exposure of an individual for each route and town along the routes was calculated for each of the five scenarios (Table 8 and Figures 10a through 10e). The values in the table assume that for Scenario 1, as an example, the same individual is present for 15 sec when each LLW truck goes through town. In Scenario 4, the "reference man" is assumed to be a diner sitting at a window table of a street-front restaurant when a LLW truck is parked along the curb while the driver stops for an hour-long meal. The occupant of an adjacent vehicle parked at a roadside rest area, where the LLW truck driver stops to sleep overnight for eight hours, is the presumed "reference man" in Scenario 5. Pahrump and Amargosa Valley exposures are for only the trucks along Routes 1 and 2, respectively. Exposures for Routes 5 and 6 are segregated, as the portion of these routes in Utah before reaching Nevada is different (Delta for Route 5 versus West Wendover and Salt Lake City for Route 6). However, as the routes converged in Nevada, a cumulative exposure for Route 5/6 was developed and is the appropriate cumulative exposure value for both Ely and Tonopah, as well as towns such as Beatty and Goldfield along U.S. Highway 95 between Tonopah and the entrance to the NTS. A total exposure for “all” trucks is calculated for Mercury, located at the NTS, as all LLW trucks pass through this location on the way to the waste management sites on the NTS. For cumulative measurements, trucks with a negative net exposure value were assigned an “adjusted net exposure” of 0.0 μR/h (see Appendix).

Table 8. Total exposures (mR) for each scenario by route and town. Cumulative exposure values are for a reference man, and assume the highly unlikely event that the same person is present for each truck along each route for the respective scenarios.

			Scenario				
			1	2	3	4	5
Route	Town	No. of Trucks	15-sec @ 1 m	1 min @ 1 m	0.5 hr @ 1 m	1 hr @ 1 m	8 hr @ 1 m
1	Pahrump, NV	384	0.0	0.1	1.9	3.8	30.3
2	Amargosa Valley, NV	42	0.0	0.0	0.4	0.7	5.8
3	Caliente, NV	0	0.0	0.0	0.0	0.0	0.0
4	Tonopah, NV	0	0.0	0.0	0.0	0.0	0.0
5	Delta, UT/ Ely/ Tonopah, NV	427	0.0	0.1	3.5	7.0	56.2
6	Salt Lake City, UT/ Ely/ Tonopah, NV	162	0.8	3.2	96.7	193.4	1,547.1
5/6*	Ely/Tonopah, NV	586	0.8	3.3	100.20	200.4	1,603.2
All	Mercury, NV	1,012	0.8	3.4	102.5	204.9	1,639.3

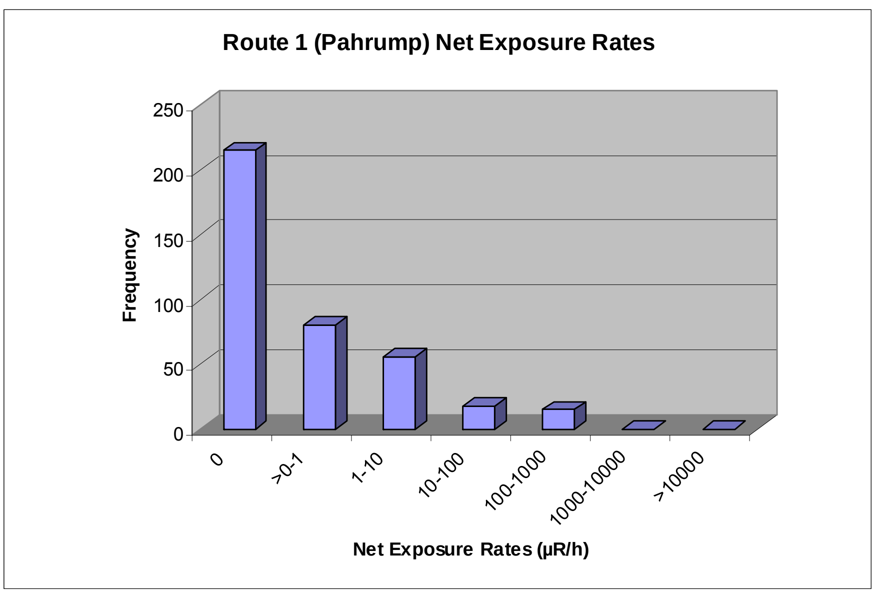

Figure 10a. Measurement frequency of the 384 trucks that traveled through Pahrump, NV (Route 1), compared to net exposure ranges in µR/h.

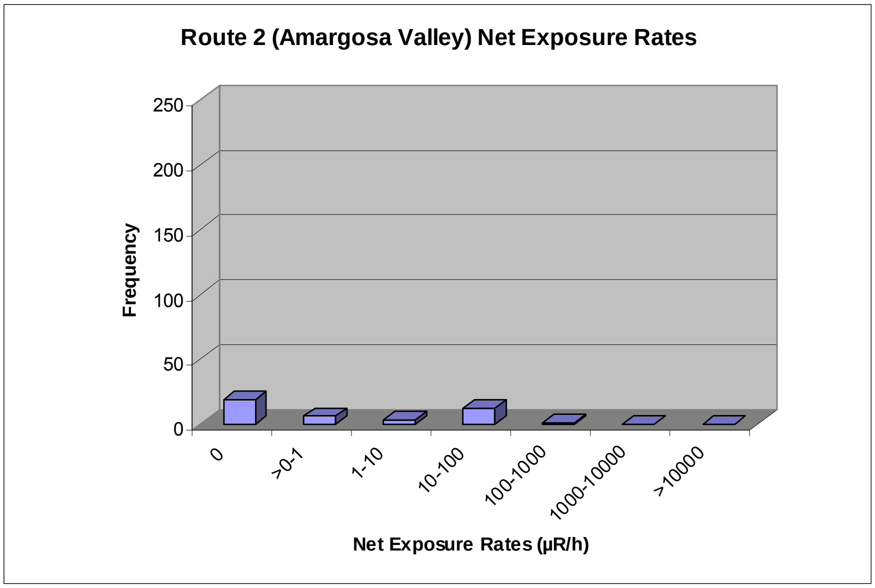

Figure 10b. Measurement frequency of the 42 trucks that traveled through Amargosa Valley, NV (Route 2), compared to net exposure ranges in µR/h.

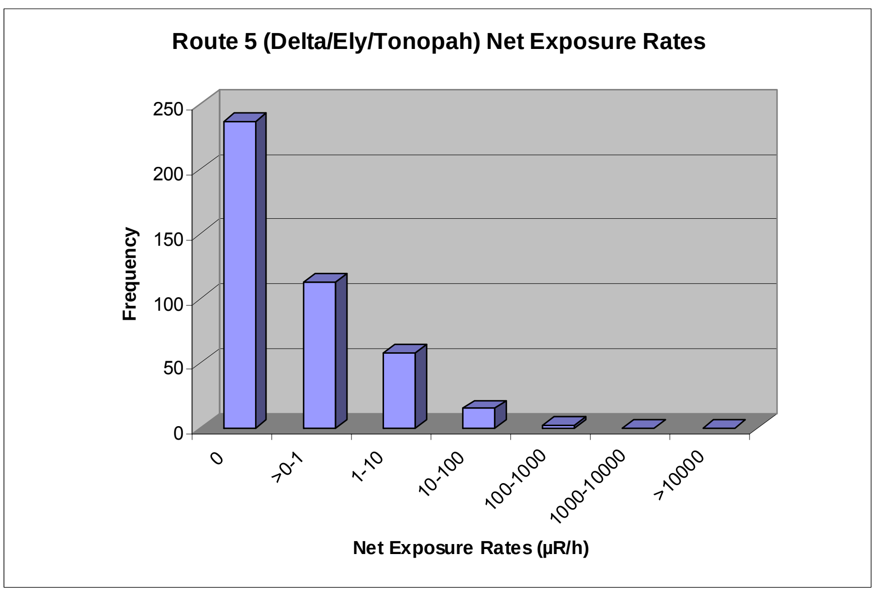

Figure 10c. Measurement frequency of the 427 trucks that traveled through Delta, UT, and Tonopah, NV (Route 5), compared to net exposure ranges in µR/h.

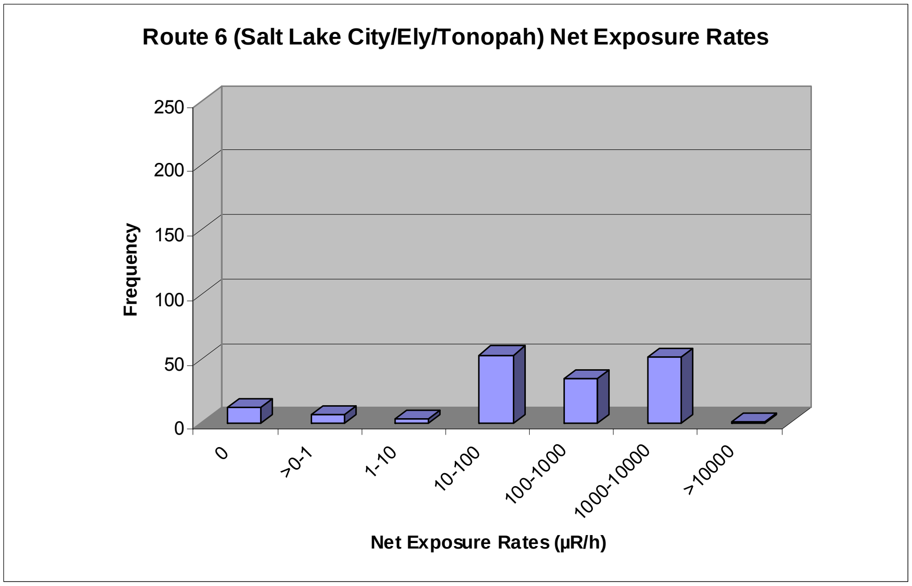

Figure 10d. Measurement frequency of the 162 trucks that traveled through Salt Lake City, UT, and Tonopah and Ely, NV (Route 6), compared to net exposure ranges in µR/h.

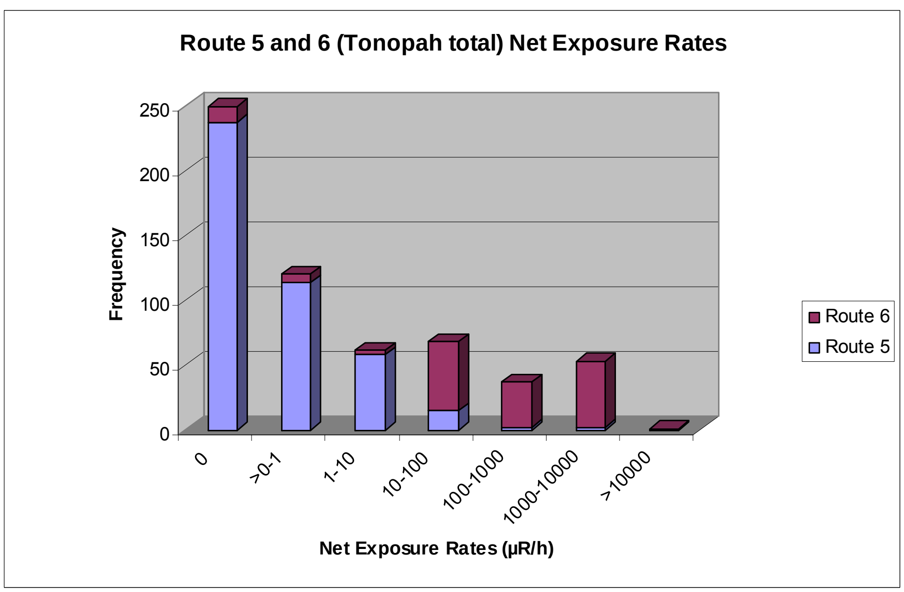

Figure 10e. Measurement frequency of the 587 trucks that traveled through combined Tonopah, NV, total (Routes 5 and 6) compared to net exposure ranges in µR/h.

Scenario 1, where a member of the public is exposed to a LLW truck for a period of 15 sec, is based on a scenario used by NNSA/NSO from Davis *et al*. (2002) in discussing potential exposure and dose to pedestrians. However, Davis *et al*. (2002) extrapolate exposure and dose measurements from 1.0 m (3.3 ft) to 2.0 m (6.6 ft) based on treatment of the truck as a line source, a technique not supported by analysis of the greater than 800 µR/h trucks examined herein. Consequently, the data presented herein for this cumulative exposure scenario are based on an exposure at 1.0 m (3.3 ft) distance. As an example, if a person was along the side of the road when each of the 42 trucks measured from Route 2 went through Amargosa Valley, assuming the 15-sec exposure (0.0042 h) of Scenario 1, his or her cumulative exposure would be 3.0 μR. However, Amargosa Valley is a good example of the sensitivity of the higher measurements on total cumulative exposure. If the highest net exposure reading of 259.2 μR/h is removed from the calculation, then the cumulative exposure for Scenario 1 is reduced to 2.0 μR, or only 66 percent of the original cumulative exposure.

Figures 10c and 10d, combined with the results of Table 8, illustrate that total exposure is not simply a function of the total trucks along a given route. For example, 427 shipments were transported along Route 5, through Delta, Utah, whereas only 162 shipments were transported along Route 6, through Salt Lake City, Utah. However, as shown in Table 8, the total net exposure for Route 6 is over 27 times that for Route 5, as is the cumulative exposure rate in each scenario. Review of Figures 10c, 10d, and 10e clearly demonstrates the difference in the distribution of the exposure rates for the trucks on these routes, with Route 6 showing the majority of the trucks having comparatively higher net exposure rates, whereas Route 5 has the majority of the trucks with lower net exposure rates.

Members of the public who are servicing LLW trucks en route to the NTS might receive some of the higher cumulative exposures. In Table 8, Scenario 3 for the combined truck traffic along Routes 5 and 6 through Ely and Tonopah might represent an attendant at a fuel station for trucks in either town. According to the cumulative exposure calculation for this scenario, such a person might receive 100 mR, the allowable exposure to a member of the public, after servicing the nearly 600 trucks that traveled through these towns. Again, this exposure is for a "reference man," as it is highly unlikely that only one attendant would be servicing all of the trucks.

Potential Individual Exposure Probabilities

A probability of an individual receiving exposure from a truck, rather than a "reference man" cumulative exposure, may be a more meaningful perspective to an individual living in one of the communities along the transportation routes. In addition, examining the probability of an individual receiving an exposure from a LLW truck also exhibits the nonGaussian nature of the data. For each of the five scenarios, the actual amount of time when an exposure might occur is comparatively short and there were long periods of times (sometimes multiple days) between trucks being recorded at the PIC array. In other words, at any one time, it is far more likely that a truck is not present as opposed to being present. However, for this exercise, the assumption is made that an individual is present within 1.0 m (3.3 ft) of a truck when it passed through their town; thus, the potential for exposure is assumed to exist.

Table 9 shows the probability that an individual might receive a net exposure from any single truck in towns along the various routes. In addition, as previously discussed, a small number of trucks contribute the majority of potential cumulative exposures, but the probability of being exposed to one of those trucks is low. For example, of the 587 LLW trucks that traveled through Tonopah, 340 of these trucks had net exposure rates greater than 0 μR/h, and 54 of the trucks had net exposure rates greater than or equal to 1,000 μR/h. This results in the probability of an individual in Tonopah receiving a potential net exposure from any single truck to be 0.58, and to a truck with a net exposure rate greater than or equal to 1,000 μR/h to be only 0.09.

In Table 9 it is assumed that an individual is present when a truck is present; however, there are far more times when a LLW truck is not present. If the individual exposure probabilities are put within context of the time periods used within the scenarios, the probability that an individual would receive an exposure from a LLW truck becomes, in reality, quite small. For example, in Table 9, the time period of 1 min of potential exposure at 1 m distance is used. As there are 525,600 minutes in a 365-day year, the probability of an individual being available to a potential exposure during a single 1-min time period in a given year is 1.9E-6. Therefore, the probability of an individual in Pahrump receiving a potential net exposure to any single truck during any specific 1-min time period within a given year is the product of the probabilities of exposure and time, or 8.4E-7. Summing all of the reasonable probabilities of an individual being exposed results in a small probability of a net exposure to an individual.

Table 9. Probability of a potential net exposure to an individual within a specific town from any single truck or to a truck with a net exposure greater than or equal to1,000 μR/h.

CEMP Town	Total number of LLW trucks	Total number of LLW trucks with net exposure above zero μR/h	Total number of LLW trucks with net exposure ≥ 1,000 μR/h
Pahrump	384	169	0
Amargosa Valley	41	22	0
Delta/Ely/Tonopah	427	190	2
Salt Lake City/ Ely/Tonopah	164	150	52
Ely/Tonopah (Total)	587	340	54
Mercury	1,012	529	54

CEMP Town	Probability of a potential net exposure from any single truck	Probability of an exposure from a truck with rate ≥ 1,000 μR/h
Pahrump	0.44	0.00
Amargosa Valley	0.54	0.00
Delta/Ely/Tonopah	0.44	0.01
Salt Lake City/ Ely/Tonopah	0.93	0.32
Ely/Tonopah (Total)	0.58	0.09
Mercury	0.52	0.05

DISCUSSION AND CONCLUSIONS

This study has shown that, based upon measurements from industry standard radiation detection instruments, such as the RS model RSS-131 PICs in a controlled configuration, a person may be exposed to gamma radiation above background when in close proximity to some LLW trucks. However, in approximately half (47.7 percent) the population of trucks measured in this study, a person would receive no exposure above background at a distance of 1.0 m (3.3 ft) away from a LLW truck. An additional 206 trucks had net exposures greater than zero, but equal to or less than 1 μR/h. Finally, nearly 80 percent of the population of trucks (802 of 1,012) had net exposures less than or equal to 10 μR/h. Although there are no shipping or exposure standards at 1.0 m (3.3 ft) distance, one relevant point of comparison is the DOT shipping standard of 10 mrem/h at 2.0 m (6.6 ft) distance. Assuming a one-to-one correspondence between Roentgens and Rems, then 903 trucks (89.2 percent of the trucks measured) were no greater than one percent of the DOT standard at 1.0 m (3.3 ft). Had the distance at which the trucks been measured increased to 2.0 m (6.6 ft), the net exposure would be even less because of the increase in distance between the truck and the receptor. However, based on the empirical data from this study, the rate of decrease may be slower than for either a point or line source as was done for previous studies (Gertz, 2001; Davis *et al*., 2001). The highest net exposure value at 1.0 m (3.3 ft) distance, 11.9 mR/h, came from the only truck with a value greater than 10 mR/h at 1.0 m (3.3 ft) distance.

The results compare favorably with conclusions from Gertz (2001) in which it was estimated that 90 percent of the LLW trucks coming to the NTS were at or below background in terms of net exposure. However, Gertz (2001) used a standard background on the NTS of 50 μR/h (with no standard deviation), a value appropriate for use at the disposal sites, but considerably higher than typical background measurements at the PIC array or for towns along transportation routes in the region. In addition, in the earlier study, a smaller data set (88 trucks) was used. Nevertheless, if the dataset described herein was analyzed for net exposure using the 50 μR/h background value, then 84.5 percent of the trucks would be below background, a result not altogether different than the estimate in Gertz (2001). However, the value of this study includes the larger population of trucks measured, the fact that they were in transit when measured, plus the use of background values particular to when each truck arrived. The authors are unaware of any study of such a large number of trucks for which systematic measurements were taken while the vehicles were in transit.

For cumulative exposure scenarios, the 100 mrem/y standard of the EPA in 10CFR834 Part B for a licensed facility (excluding exposures from radon and medical devices) was used as a basis of comparison. The comparison assumes a one-to-one correspondence between Roentgens and Rems (Shleien *et al*., 1998). Even when cumulative exposures are calculated for short exposures of time (for example, Scenario 1), the results are still a small percentage of the 10CFR834 Subpart B public dose limit. However, when calculating cumulative exposures for different scenarios, the results can be strongly sensitive to a relatively few high measurements. Only 5.3 percent of the trucks measured in this study had external readings exceeding 1,000 μR/h. Nevertheless, as illustrated in the comparison of the average exposure from a 15-sec period of a pedestrian along side of a LLW truck in Amargosa Valley, including or excluding one higher value can significantly change the cumulative exposure rate.

Although the results of this study indicate that individual truck and cumulative exposure measurements were well below relevant DOT and EPA standards, it is recommended that NNSA/NSO update some information that it presents to the public on LLW transportation to the NTS. For example, if the measurements collected during this study are representative, then the result of the highest "actual NTS shipment" of 1,000 μR at contact with the truck, as reported in Davis *et al*. (2002), is now on the low side. This conclusion is reached by examining the PIC data, but also demonstrated in the manual measurements taken by RCTs at the Area 3 RWMS and Area 5 RWMC at the NTS. In addition, when examining the entire population of trucks, the distribution is nonGaussian. Consequently, an "average" truck is not an appropriate statistical measure. Instead, it may be more appropriate to talk about three populations of trucks. The first and the largest is those that represent no potential exposure (47.7 percent). The second is those close to zero (20.4 percent with positive net exposures rates less than 1 μR/h). Finally, the smallest population is those that dominate cumulative exposure measurements, i.e., the 5.3 percent of trucks with net exposure rates greater than 1,000 μR/h.

The results presented herein on differences in the number of trucks and cumulative exposure along particular routes to the NTS should only be considered a snapshot in time. Nevertheless, some trends may continue for the next few years with the accelerated closure of DOE sites. That is, the number of shipments and total potential exposure along routes through Nevada towns such as Ely, Tonopah, Beatty, and Goldfield are likely to remain higher than shipments through Amargosa Valley or Pahrump. However, the potential exposure will be dependent upon the waste type, an aspect that was not analyzed in this study because of the voluntary nature of the study and the decision not to identify waste generators.

RECOMMENDATIONS

As previously mentioned, nearly all investigations regarding exposure from LLW truck transportation involved calculated versus measured exposures and doses. In fact, in searching the literature, and in talking with others in the waste transportation field, the authors were not able to identify another project where such a large population of LLW trucks, particularly during transport, was systematically measured as was done for this study. Certainly, at radioactive waste management facilities, including the RWMC and RWMS at the NTS, RCTs take measurements with hand-held instruments to compare against DOT shipping standards. However, the data quality objectives of those measurements do not require the same level of precision that was the goal of this study.

Nevertheless, if further investigations of this type are performed, the following are some lessons-learned that may be included in future studies:

1. Use a traffic counter for recording when trucks entered the PIC array. A common error made by truck drivers was to record the time at the place of waste origin when they arrived at the PIC array, rather than that of the Pacific Time Zone. While these errors in time zone were corrected, the number of logbook errors and the amount of time necessary to make the corrections were underestimated. The number of errors might be reduced by using a traffic counter tied to a datalogger. The traffic counter would also be another line of evidence for cases where it is suspected that a LLW truck entered the PIC array, but the driver recorded no information about the shipment.

2. If possible, do measurements at a facility where there is more control over participation of drivers in the study. It would have been ideal, but prohibitively expensive, to have a person at the NTS PIC facility to guide drivers through the process and make certain that data on the waste shipment were all correctly recorded in the logbook. For a future study that involved multiple means of transport of shipping containers, an intermodal facility might be an ideal location. All carriers would need to stop, and likely there would be personnel present at all times whom could assist with the quality of the data that are recorded about the waste shipment that would accompany the exposure measurements taken.

3. Measurements taken at an intermodal facility could also allow a larger number of measurements to be taken of the trucks. One of the values in automating the PIC array for this study, and having radiation instruments that stabilized quickly when a truck arrived, is that the amount of time required by the truck drivers to participate in the study was small. In talking to truck drivers who used it, the fact that little time was required for them to participate in the study was an important reason for using the PIC array. However, it resulted in relatively few measurements for each truck. In contrast, the number of measurements of background was significant and far more could be done statistically with these values. At an intermodal facility, it might be possible to collect a larger number of measurements for each truck and improve the analytical value of the gross measurement readings.

4. Explore alternative instruments for recording higher gamma readings or taking measurements with multiple instruments with different total gamma sensitivity ranges. The RS model RSS-131 high pressure PICs were used in large part because they are cost effective and widely used for offsite monitoring around the NTS and at other DOE sites and facilities. In addition, because it is an important instrument used by the CEMP for gamma radiation measurements, stakeholders in many rural towns along LLW transportation routes to the NTS are familiar with the output of the instrument. In designing the study, DRI emphasized the ability to measure relatively small net gamma readings because of the assumption (true in most cases) that if a LLW truck was detectable above background, it would not significantly exceed background.

   However, choosing this model PIC created problems for the gross measurement for the 59 trucks at the PIC array exceeded approximately 800 μR/h. A possible approach in the future would be to combine measurements from one instrument sensitive to the lower-range end of gamma measurements with measurements from one more sensitive to higher net gamma readings. While rare, the trucks with higher external gamma measurements contribute significantly to cumulative exposure measures. Consequently, it is important that these few higher measurements be as accurate as possible.

5. As previously discussed, in the examination of trucks with exposure values greater than 800 μR/h, the decrease in values with increasing distance from the truck may be much slower than would be predicted for a point or even a line source. No references were found discussing this phenomenon; thus, it is recommended that this phenomenon specifically be investigated. This could be done with a mobile PIC, taking various measurements versus distance with one or more LLW trucks. The

trucks would need to have similar characteristic waste loads (probably randomly distributed heterogeneous packages, constituting a large bulky source such as measured in this study at the PIC array and at the Area 5 RWMC and Area 3 RWMS). Radiation readings would need to be sufficiently high to obtain readings from at least 2.0 m (6.6 ft) distance away from the truck.

6. A slightly larger database could have been created had the truck drivers more accurately recorded information about their shipment. Although DOT shipping standards require that a driver be able to furnish and have readily at hand information such as the WSIN in the event of an accident or other emergency, it is not at all clear from this study that all drivers sufficiently understand their shipping documentation. For a future study of this type, part of the instructions to waste generators could be to brief their drivers on where to find the pertinent information they will need to provide at the point where external exposure readings of the truck will be measured. Alternatively, waste generators could develop a card specifically designed for the transportation study that the driver would carry en route. When the driver arrived at the PIC array, he or she would time-punch the card and leave it in a drop box. While such an approach would increase up-front time and costs, it would significantly reduce the time spent reconstructing missing information as well as potentially increasing the percent of shipments for which exposure data are collected.

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APPENDIX

Gross, Net, and Adjusted Net Measurements for LLW Trucks

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
1	July 21, 2003	4:08:00 AM	14.84	14.14	7.35	-6.65	0.00	5
2	July 20, 2003	9:18:00 PM	15.07	14.14	7.35	-6.42	0.00	5
3	June 22, 2003	11:08:00 PM	14.84	14.16	6.90	-6.22	0.00	2
4	May 13, 2003	6:34:00 PM	15.57	14.14	7.29	-5.86	0.00	2
5	August 17, 2003	9:06:00 PM	14.12	14.19	5.25	-5.32	0.00	5
6	June 22, 2003	11:30:00 PM	16.11	14.16	6.90	-4.95	0.00	2
7	September 1, 2003	10:22:00 PM	14.54	14.13	4.96	-4.55	0.00	1
8	November 13, 2003	7:34:00 AM	13.93	13.89	4.37	-4.33	0.00	1
9	August 18, 2003	7:26:00 AM	15.32	14.19	5.25	-4.12	0.00	5
10	November 13, 2003	4:44:00 AM	14.17	13.89	4.37	-4.09	0.00	1
11	August 18, 2003	1:00:00 AM	15.56	14.19	5.25	-3.88	0.00	5
12	September 11, 2003	1:10:00 AM	14.85	13.90	4.68	-3.73	0.00	1
13	September 11, 2003	5:48:00 AM	14.85	13.90	4.68	-3.73	0.00	1
14	September 11, 2003	5:56:00 AM	14.85	13.90	4.68	-3.73	0.00	1
15	September 11, 2003	6:08:00 AM	14.85	13.90	4.68	-3.73	0.00	1
16	November 17, 2003	6:30:00 AM	14.17	13.74	4.08	-3.65	0.00	6
17	October 12, 2003	5:10:00 PM	14.84	14.15	4.16	-3.47	0.00	5
18	October 12, 2003	5:16:00 PM	14.84	14.15	4.16	-3.47	0.00	6
19	November 17, 2003	4:36:00 AM	14.35	13.74	4.08	-3.47	0.00	5
20	September 11, 2003	5:44:00 AM	15.14	13.90	4.68	-3.44	0.00	1
21	November 17, 2003	4:34:00 AM	14.38	13.74	4.08	-3.44	0.00	5
22	August 14, 2003	5:12:00 AM	14.61	13.81	4.23	-3.43	0.00	1
23	August 14, 2003	6:04:00 AM	14.61	13.81	4.23	-3.43	0.00	5
24	November 13, 2003	7:36:00 AM	14.84	13.89	4.37	-3.42	0.00	1
25	November 16, 2003	9:28:00 PM	14.41	13.74	4.08	-3.41	0.00	1
26	July 23, 2003	7:58:00 AM	14.40	14.12	3.69	-3.41	0.00	5
27	November 5, 2003	5:56:00 AM	13.90	13.58	3.66	-3.34	0.00	5
28	August 14, 2003	6:06:00 AM	14.84	13.81	4.23	-3.20	0.00	5
29	July 21, 2003	12:44:00 AM	18.30	14.14	7.35	-3.19	0.00	5
30	August 14, 2003	5:50:00 AM	15.08	13.81	4.23	-2.96	0.00	1
31	August 14, 2003	5:52:00 AM	15.08	13.81	4.23	-2.96	0.00	5
32	August 14, 2003	6:00:00 AM	15.13	13.81	4.23	-2.91	0.00	1
33	September 4, 2003	5:50:00 AM	14.85	13.89	3.84	-2.88	0.00	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
34	September 4, 2003	6:06:00 AM	14.85	13.89	3.84	-2.88	0.00	1
35	September 3, 2003	11:00:00 PM	15.08	13.89	3.84	-2.65	0.00	1
36	September 4, 2003	5:26:00 AM	15.09	13.89	3.84	-2.64	0.00	5
37	September 4, 2003	5:46:00 AM	15.09	13.89	3.84	-2.64	0.00	1
38	September 4, 2003	5:48:00 AM	15.09	13.89	3.84	-2.64	0.00	1
39	October 14, 2003	6:30:00 AM	14.84	13.85	3.57	-2.58	0.00	5
40	September 11, 2003	1:12:00 AM	16.11	13.90	4.68	-2.47	0.00	5
41	November 13, 2003	5:00:00 AM	15.82	13.89	4.37	-2.44	0.00	1
42	April 23, 2003	6:10:00 AM	13.66	14.03	2.05	-2.42	0.00	5
43	September 11, 2003	8:00:00 PM	13.89	13.80	2.48	-2.39	0.00	5
44	October 14, 2003	6:52:00 AM	15.08	13.85	3.57	-2.34	0.00	5
45	March 13, 2003	6:50:00 AM	13.35	13.64	1.99	-2.28	0.00	5
46	February 13, 2003	3:54:00 PM	13.68	13.73	2.21	-2.26	0.00	1
47	November 10, 2003	4:44:00 AM	13.65	13.52	2.32	-2.19	0.00	5
48	July 23, 2003	5:22:00 AM	13.88	14.37	1.67	-2.16	0.00	5
49	April 14, 2003	6:12:00 AM	14.14	13.61	2.66	-2.13	0.00	5
50	September 2, 2003	4:10:00 AM	16.97	14.13	4.96	-2.12	0.00	2
51	July 15, 2003	5:50:00 AM	15.08	13.90	3.26	-2.08	0.00	5
52	July 15, 2003	5:54:00 AM	15.08	13.90	3.26	-2.08	0.00	5
53	July 15, 2003	6:02:00 AM	15.08	13.90	3.26	-2.08	0.00	1
54	July 15, 2003	6:04:00 AM	15.13	13.90	3.26	-2.03	0.00	1
55	December 15, 2003	5:46:00 PM	12.46	13.29	1.19	-2.02	0.00	5
56	April 30, 2003	5:14:00 AM	14.17	13.82	2.36	-2.01	0.00	5
57	November 17, 2003	6:06:00 AM	15.82	13.74	4.08	-2.00	0.00	5
58	September 8, 2003	7:56:00 AM	15.33	13.96	3.35	-1.98	0.00	5
59	April 15, 2003	5:56:00 AM	13.66	14.38	1.26	-1.98	0.00	5
60	September 25, 2003	3:22:00 AM	14.61	14.00	2.59	-1.98	0.00	5
61	June 20, 2003	6:00:00 AM	14.61	13.99	2.58	-1.96	0.00	5
62	June 20, 2003	6:10:00 AM	14.61	13.99	2.58	-1.96	0.00	5
63	June 20, 2003	6:12:00 AM	14.61	13.99	2.58	-1.96	0.00	5
64	September 23, 2003	3:44:00 AM	15.33	14.07	3.22	-1.96	0.00	5
65	September 23, 2003	3:48:00 AM	15.33	14.07	3.22	-1.96	0.00	1
66	May 15, 2003	6:24:00 AM	14.61	13.90	2.66	-1.95	0.00	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
67	April 23, 2003	6:04:00 AM	14.17	14.03	2.05	-1.91	0.00	5
68	July 23, 2003	5:42:00 AM	14.15	14.37	1.67	-1.89	0.00	5
69	September 28, 2003	9:56:00 PM	14.60	13.97	2.51	-1.88	0.00	1
70	July 15, 2003	6:00:00 AM	15.32	13.90	3.26	-1.84	0.00	1
71	April 30, 2003	7:00:00 AM	14.38	13.82	2.36	-1.80	0.00	5
72	April 23, 2003	6:02:00 AM	14.35	14.03	2.05	-1.73	0.00	5
73	April 23, 2003	6:12:00 AM	14.35	14.03	2.05	-1.73	0.00	5
74	April 14, 2003	6:14:00 AM	14.55	13.61	2.66	-1.72	0.00	5
75	April 23, 2003	6:00:00 AM	14.38	14.03	2.05	-1.70	0.00	5
76	August 25, 2003	5:58:00 PM	14.15	13.84	2.00	-1.69	0.00	1
77	September 28, 2003	9:54:00 PM	14.84	13.97	2.51	-1.64	0.00	1
78	December 18, 2003	6:04:00 AM	12.95	13.40	1.18	-1.63	0.00	5
79	March 12, 2003	6:20:00 AM	13.58	13.77	1.40	-1.59	0.00	5
80	April 29, 2003	9:04:00 PM	14.61	13.82	2.36	-1.57	0.00	1
81	April 29, 2003	9:18:00 PM	14.61	13.82	2.36	-1.57	0.00	1
82	June 20, 2003	5:26:00 AM	15.03	13.99	2.58	-1.54	0.00	5
83	November 10, 2003	4:46:00 AM	14.31	13.52	2.32	-1.53	0.00	5
84	July 22, 2003	6:06:00 AM	13.88	13.91	1.49	-1.52	0.00	1
85	June 19, 2003	10:00:00 PM	15.08	13.99	2.58	-1.49	0.00	1
86	June 19, 2003	11:02:00 PM	15.08	13.99	2.58	-1.49	0.00	1
87	June 20, 2003	1:28:00 AM	15.08	13.99	2.58	-1.49	0.00	1
88	March 11, 2003	8:56:00 PM	13.68	13.77	1.40	-1.49	0.00	1
89	March 12, 2003	6:16:00 AM	13.68	13.77	1.40	-1.49	0.00	5
90	February 23, 2003	2:00:00 PM	14.30	13.83	1.96	-1.48	0.00	2
91	September 28, 2003	9:02:00 PM	15.03	13.97	2.51	-1.45	0.00	1
92	June 9, 2003	5:48:00 AM	14.61	14.03	2.03	-1.45	0.00	5
93	September 21, 2003	8:04:00 PM	14.36	13.84	1.96	-1.44	0.00	1
94	May 4, 2003	9:30:00 PM	13.89	13.70	1.60	-1.41	0.00	1
95	September 16, 2003	5:52:00 PM	13.91	13.96	1.35	-1.40	0.00	5
96	April 29, 2003	10:44:00 PM	14.79	13.82	2.36	-1.39	0.00	1
97	April 29, 2003	10:54:00 PM	14.79	13.82	2.36	-1.39	0.00	1
98	June 30, 2003	10:40:00 PM	13.57	13.65	1.28	-1.36	0.00	1
99	September 28, 2003	9:42:00 PM	15.13	13.97	2.51	-1.35	0.00	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
100	August 10, 2003	6:58:00 PM	13.91	13.75	1.51	-1.34	0.00	1
101	December 2, 2003	7:04:00 PM	13.42	13.47	1.29	-1.34	0.00	5
102	July 22, 2003	5:56:00 AM	14.06	13.91	1.49	-1.34	0.00	1
103	July 22, 2003	6:02:00 AM	14.06	13.91	1.49	-1.34	0.00	1
104	April 29, 2003	10:58:00 PM	14.85	13.82	2.36	-1.33	0.00	1
105	April 8, 2003	9:12:00 PM	13.92	13.66	1.59	-1.33	0.00	1
106	October 9, 2003	7:12:00 AM	14.13	13.89	1.54	-1.30	0.00	5
107	October 9, 2003	7:14:00 AM	14.13	13.89	1.54	-1.30	0.00	5
108	August 19, 2003	4:10:00 AM	13.89	13.86	1.31	-1.28	0.00	1
109	August 19, 2003	5:38:00 AM	13.89	13.86	1.31	-1.28	0.00	1
110	October 8, 2003	6:22:00 AM	14.37	13.88	1.72	-1.23	0.00	5
111	July 22, 2003	5:08:00 PM	14.12	14.07	1.26	-1.21	0.00	5
112	June 9, 2003	6:02:00 AM	14.85	14.03	2.03	-1.21	0.00	5
113	September 11, 2003	8:02:00 PM	15.08	13.80	2.48	-1.20	0.00	5
114	March 16, 2003	7:46:00 PM	14.41	13.77	1.83	-1.20	0.00	5
115	September 16, 2003	7:34:00 PM	14.12	13.96	1.35	-1.19	0.00	1
116	May 4, 2003	9:28:00 PM	14.13	13.70	1.60	-1.17	0.00	2
117	December 18, 2003	6:06:00 AM	13.42	13.40	1.18	-1.16	0.00	5
118	September 28, 2003	10:04:00 PM	15.32	13.97	2.51	-1.16	0.00	1
119	June 30, 2003	7:06:00 PM	13.88	13.80	1.23	-1.15	0.00	5
120	July 12, 2003	4:38:00 PM	14.12	13.97	1.29	-1.14	0.00	1
121	September 23, 2003	2:20:00 PM	14.60	13.99	1.74	-1.13	0.00	1
122	August 20, 2003	7:24:00 AM	15.09	14.48	1.73	-1.12	0.00	5
123	April 9, 2003	6:26:00 AM	14.14	13.66	1.59	-1.11	0.00	5
124	May 21, 2003	7:06:00 PM	14.08	13.84	1.35	-1.11	0.00	5
125	June 8, 2003	5:48:00 PM	14.15	14.01	1.24	-1.10	0.00	5
126	May 22, 2003	6:18:00 AM	14.37	13.72	1.75	-1.10	0.00	5
127	May 22, 2003	6:30:00 AM	14.37	13.72	1.75	-1.10	0.00	5
128	May 11, 2003	11:42:00 PM	14.41	13.67	1.84	-1.10	0.00	2
129	May 20, 2003	6:04:00 AM	14.13	13.72	1.50	-1.09	0.00	5
130	December 2, 2003	3:00:00 PM	13.67	13.47	1.29	-1.09	0.00	1
131	May 13, 2003	6:00:00 AM	13.89	13.67	1.31	-1.09	0.00	5
132	May 13, 2003	6:04:00 AM	13.89	13.67	1.31	-1.09	0.00	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
133	October 9, 2003	7:16:00 AM	14.37	13.89	1.54	-1.06	0.00	5
134	August 17, 2003	1:14:00 PM	14.15	13.90	1.29	-1.05	0.00	1
135	December 15, 2003	7:26:00 PM	13.44	13.29	1.19	-1.04	0.00	5
136	October 23, 2003	7:56:00 AM	14.13	13.75	1.42	-1.04	0.00	1
137	September 21, 2003	8:12:00 PM	14.78	13.84	1.96	-1.02	0.00	1
138	July 27, 2003	10:30:00 PM	13.88	13.77	1.13	-1.02	0.00	1
139	April 20, 2003	8:36:00 PM	14.16	13.88	1.29	-1.01	0.00	1
140	July 14, 2003	6:00:00 PM	14.36	13.96	1.40	-1.00	0.00	6
141	July 14, 2003	7:20:00 AM	13.88	13.75	1.13	-1.00	0.00	5
142	June 22, 2003	7:18:00 PM	14.12	13.83	1.28	-0.99	0.00	1
143	June 9, 2003	12:42:00 AM	15.08	14.03	2.03	-0.98	0.00	1
144	May 21, 2003	4:34:00 AM	14.13	13.73	1.37	-0.97	0.00	5
145	September 21, 2003	8:06:00 PM	14.83	13.84	1.96	-0.97	0.00	1
146	May 8, 2003	5:00:00 AM	14.14	13.83	1.28	-0.97	0.00	6
147	June 9, 2003	6:06:00 AM	15.09	14.03	2.03	-0.97	0.00	5
148	June 9, 2003	6:42:00 AM	15.09	14.03	2.03	-0.97	0.00	1
149	March 20, 2003	7:04:00 PM	13.89	13.71	1.14	-0.96	0.00	1
150	August 12, 2003	6:04:00 AM	13.88	13.73	1.11	-0.96	0.00	1
151	August 12, 2003	6:16:00 AM	13.88	13.73	1.11	-0.96	0.00	1
152	July 23, 2003	5:36:00 AM	15.08	14.37	1.67	-0.96	0.00	5
153	July 20, 2003	6:58:00 PM	14.15	13.86	1.25	-0.95	0.00	1
154	June 19, 2003	10:58:00 PM	15.62	13.99	2.58	-0.95	0.00	5
155	September 22, 2003	6:44:00 AM	14.85	13.84	1.96	-0.95	0.00	5
156	September 22, 2003	6:50:00 AM	14.85	13.84	1.96	-0.95	0.00	5
157	September 22, 2003	7:30:00 AM	14.85	13.84	1.96	-0.95	0.00	6
158	April 2, 2003	5:18:00 AM	14.38	13.87	1.46	-0.95	0.00	1
159	April 2, 2003	5:48:00 AM	14.38	13.87	1.46	-0.95	0.00	5
160	May 5, 2003	6:14:00 AM	14.37	13.70	1.60	-0.93	0.00	5
161	May 5, 2003	6:18:00 AM	14.37	13.70	1.60	-0.93	0.00	5
162	May 15, 2003	4:52:00 AM	15.63	13.90	2.66	-0.93	0.00	1
163	April 18, 2003	5:58:00 AM	13.90	13.70	1.13	-0.93	0.00	5
164	September 14, 2003	6:26:00 PM	14.36	13.77	1.52	-0.93	0.00	1
165	August 11, 2003	4:00:00 PM	14.15	13.85	1.23	-0.92	0.00	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
166	December 10, 2003	3:32:00 AM	13.86	13.52	1.26	-0.92	0.00	1
167	December 18, 2003	5:14:00 AM	13.66	13.40	1.18	-0.92	0.00	5
168	September 28, 2003	9:48:00 PM	15.56	13.97	2.51	-0.92	0.00	1
169	September 29, 2003	2:54:00 AM	15.56	13.97	2.51	-0.92	0.00	1
170	April 8, 2003	9:08:00 PM	14.34	13.66	1.59	-0.91	0.00	1
171	April 8, 2003	9:10:00 PM	14.34	13.66	1.59	-0.91	0.00	1
172	December 18, 2003	4:42:00 AM	13.68	13.40	1.18	-0.90	0.00	5
173	June 8, 2003	3:58:00 PM	14.36	14.01	1.24	-0.89	0.00	5
174	April 14, 2003	6:10:00 AM	15.39	13.61	2.66	-0.88	0.00	1
175	April 14, 2003	6:16:00 AM	15.39	13.61	2.66	-0.88	0.00	5
176	July 1, 2003	7:00:00 PM	14.12	13.80	1.19	-0.87	0.00	5
177	September 7, 2003	10:16:00 PM	14.12	13.82	1.16	-0.87	0.00	1
178	September 7, 2003	10:20:00 PM	14.12	13.82	1.16	-0.87	0.00	1
179	March 5, 2003	9:38:00 PM	13.90	13.53	1.23	-0.86	0.00	1
180	July 21, 2003	9:24:00 PM	14.54	13.91	1.49	-0.86	0.00	1
181	April 10, 2003	5:08:00 AM	14.14	13.73	1.27	-0.86	0.00	5
182	May 21, 2003	6:58:00 PM	14.33	13.84	1.35	-0.86	0.00	5
183	April 16, 2003	3:30:00 AM	13.90	13.55	1.18	-0.83	0.00	1
184	May 16, 2003	6:16:00 AM	14.13	13.68	1.28	-0.83	0.00	5
185	July 21, 2003	8:36:00 AM	14.36	13.96	1.22	-0.83	0.00	1
186	December 15, 2003	5:46:00 AM	13.69	13.39	1.12	-0.82	0.00	5
187	May 19, 2003	5:46:00 AM	13.89	13.65	1.06	-0.82	0.00	5
188	August 19, 2003	6:04:00 AM	14.36	13.86	1.31	-0.81	0.00	1
189	November 17, 2003	6:00:00 AM	17.01	13.74	4.08	-0.81	0.00	5
190	April 21, 2003	5:58:00 AM	14.37	13.88	1.29	-0.80	0.00	5
191	October 23, 2003	8:02:00 AM	14.37	13.75	1.42	-0.80	0.00	1
192	May 16, 2003	6:10:00 AM	14.16	13.68	1.28	-0.80	0.00	5
193	July 11, 2003	11:24:00 AM	14.36	13.96	1.19	-0.79	0.00	1
194	August 11, 2003	7:36:00 AM	14.12	13.69	1.22	-0.78	0.00	5
195	October 9, 2003	7:10:00 AM	14.65	13.89	1.54	-0.78	0.00	1
196	August 21, 2003	5:44:00 AM	14.85	13.63	1.99	-0.77	0.00	5
197	August 21, 2003	6:10:00 AM	14.85	13.63	1.99	-0.77	0.00	1
198	September 11, 2003	8:08:00 PM	15.51	13.80	2.48	-0.77	0.00	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
199	August 19, 2003	5:40:00 AM	14.40	13.86	1.31	-0.77	0.00	1
200	November 6, 2003	4:46:00 AM	13.90	13.45	1.22	-0.77	0.00	5
201	April 28, 2003	4:14:00 AM	14.07	13.68	1.15	-0.76	0.00	1
202	August 10, 2003	9:00:00 PM	14.15	13.69	1.22	-0.75	0.00	1
203	May 5, 2003	6:20:00 AM	14.55	13.70	1.60	-0.75	0.00	5
204	April 17, 2003	6:12:00 AM	14.14	13.68	1.20	-0.75	0.00	5
205	April 17, 2003	6:22:00 AM	14.14	13.68	1.20	-0.75	0.00	5
206	November 11, 2003	5:26:00 PM	13.84	13.46	1.12	-0.74	0.00	5
207	June 8, 2003	9:02:00 PM	15.32	14.03	2.03	-0.74	0.00	6
208	June 9, 2003	6:30:00 AM	15.32	14.03	2.03	-0.74	0.00	1
209	May 26, 2003	8:20:00 PM	14.36	13.81	1.28	-0.73	0.00	1
210	March 13, 2003	6:54:00 AM	14.90	13.64	1.99	-0.73	0.00	5
211	April 24, 2003	4:48:00 AM	14.14	13.70	1.17	-0.73	0.00	5
212	May 1, 2003	7:44:00 AM	14.37	13.72	1.37	-0.72	0.00	1
213	August 12, 2003	6:24:00 AM	14.12	13.73	1.11	-0.72	0.00	1
214	April 2, 2003	5:22:00 AM	14.61	13.87	1.46	-0.72	0.00	1
215	May 1, 2003	6:16:00 AM	14.38	13.72	1.37	-0.71	0.00	5
216	July 7, 2003	5:34:00 PM	14.64	13.98	1.37	-0.71	0.00	5
217	September 22, 2003	6:40:00 AM	15.09	13.84	1.96	-0.71	0.00	5
218	May 15, 2003	5:30:00 PM	14.36	13.81	1.25	-0.70	0.00	5
219	May 8, 2003	12:22:00 AM	14.41	13.83	1.28	-0.70	0.00	1
220	July 10, 2003	6:36:00 PM	14.36	13.91	1.15	-0.70	0.00	1
221	May 21, 2003	5:14:00 AM	14.41	13.73	1.37	-0.69	0.00	5
222	July 22, 2003	5:06:00 PM	14.64	14.07	1.26	-0.69	0.00	5
223	December 18, 2003	3:44:00 AM	13.90	13.40	1.18	-0.68	0.00	1
224	September 21, 2003	5:44:00 PM	14.30	13.90	1.07	-0.67	0.00	1
225	May 18, 2003	6:24:00 PM	14.33	13.80	1.20	-0.67	0.00	5
226	April 16, 2003	6:08:00 AM	14.07	13.55	1.18	-0.66	0.00	5
227	September 19, 2003	10:54:00 AM	14.33	13.78	1.21	-0.66	0.00	2
228	April 2, 2003	8:08:00 PM	14.38	13.68	1.36	-0.66	0.00	5
229	October 29, 2003	6:00:00 AM	14.13	13.54	1.24	-0.65	0.00	5
230	September 23, 2003	11:38:00 PM	15.09	13.99	1.74	-0.64	0.00	1
231	June 30, 2003	6:30:00 PM	14.40	13.80	1.23	-0.63	0.00	6

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
232	June 30, 2003	7:02:00 PM	14.40	13.80	1.23	-0.63	0.00	5
233	September 19, 2003	10:48:00 AM	14.36	13.78	1.21	-0.63	0.00	2
234	April 7, 2003	6:14:00 AM	14.07	13.53	1.17	-0.63	0.00	5
235	November 17, 2003	9:00:00 PM	13.83	13.24	1.21	-0.62	0.00	5
236	July 22, 2003	6:52:00 AM	14.78	13.91	1.49	-0.62	0.00	1
237	April 10, 2003	5:06:00 AM	14.38	13.73	1.27	-0.62	0.00	5
238	June 12, 2003	6:00:00 PM	14.64	13.94	1.32	-0.62	0.00	1
239	September 21, 2003	5:46:00 PM	14.36	13.90	1.07	-0.61	0.00	1
240	November 20, 2003	4:56:00 AM	14.10	13.46	1.25	-0.61	0.00	5
241	December 15, 2003	5:38:00 AM	13.91	13.39	1.12	-0.60	0.00	5
242	July 21, 2003	9:28:00 PM	14.82	13.91	1.49	-0.58	0.00	1
243	October 7, 2003	6:52:00 AM	14.37	13.84	1.10	-0.57	0.00	5
244	June 20, 2003	6:50:00 AM	16.00	13.99	2.58	-0.57	0.00	5
245	September 28, 2003	3:50:00 PM	14.64	13.99	1.21	-0.56	0.00	1
246	April 21, 2003	7:30:00 AM	14.61	13.88	1.29	-0.56	0.00	1
247	April 21, 2003	7:34:00 AM	14.61	13.88	1.29	-0.56	0.00	1
248	April 16, 2003	6:06:00 AM	14.17	13.55	1.18	-0.56	0.00	5
249	July 22, 2003	6:04:00 AM	14.84	13.91	1.49	-0.56	0.00	1
250	April 16, 2003	8:16:00 AM	14.38	13.65	1.29	-0.56	0.00	1
251	April 7, 2003	6:10:00 AM	14.14	13.53	1.17	-0.56	0.00	5
252	May 8, 2003	5:44:00 AM	14.56	13.83	1.28	-0.55	0.00	5
253	May 16, 2003	6:14:00 AM	14.41	13.68	1.28	-0.55	0.00	5
254	May 15, 2003	6:26:00 AM	16.01	13.90	2.66	-0.55	0.00	1
255	April 30, 2003	7:02:00 AM	15.64	13.82	2.36	-0.54	0.00	5
256	June 1, 2003	6:44:00 PM	14.33	13.70	1.15	-0.52	0.00	5
257	August 24, 2003	7:44:00 PM	14.33	13.73	1.12	-0.52	0.00	5
258	October 8, 2003	1:00:00 AM	15.09	13.88	1.72	-0.51	0.00	1
259	August 27, 2003	7:30:00 AM	14.61	13.60	1.52	-0.51	0.00	5
260	April 17, 2003	5:54:00 AM	14.38	13.68	1.20	-0.51	0.00	5
261	April 17, 2003	6:10:00 AM	14.38	13.68	1.20	-0.51	0.00	5
262	May 20, 2003	9:04:00 PM	14.60	13.73	1.37	-0.50	0.00	1
263	November 12, 2003	3:30:00 PM	15.82	14.66	1.66	-0.50	0.00	1
264	July 27, 2003	8:00:00 PM	14.40	13.77	1.13	-0.50	0.00	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
265	May 26, 2003	8:22:00 PM	14.60	13.81	1.28	-0.49	0.00	2
266	July 23, 2003	5:38:00 AM	14.60	13.81	1.28	-0.49	0.00	5
267	May 20, 2003	10:50:00 PM	14.61	13.73	1.37	-0.49	0.00	1
268	May 21, 2003	6:02:00 AM	14.61	13.73	1.37	-0.49	0.00	5
269	September 18, 2003	11:30:00 PM	14.37	13.60	1.26	-0.49	0.00	1
270	September 19, 2003	5:12:00 AM	14.37	13.60	1.26	-0.49	0.00	1
271	September 19, 2003	5:40:00 AM	14.37	13.60	1.26	-0.49	0.00	5
272	September 19, 2003	5:52:00 AM	14.37	13.60	1.26	-0.49	0.00	5
273	September 19, 2003	5:54:00 AM	14.37	13.60	1.26	-0.49	0.00	5
274	September 19, 2003	6:10:00 AM	14.37	13.60	1.26	-0.49	0.00	1
275	July 13, 2003	10:42:00 PM	14.40	13.75	1.13	-0.48	0.00	1
276	October 20, 2003	5:30:00 AM	14.13	13.57	1.04	-0.48	0.00	5
277	October 20, 2003	5:52:00 AM	14.13	13.57	1.04	-0.48	0.00	1
278	April 28, 2003	9:10:00 PM	14.65	13.75	1.37	-0.47	0.00	2
279	July 20, 2003	6:54:00 PM	14.64	13.86	1.25	-0.46	0.00	1
280	October 12, 2003	3:18:00 AM	14.37	13.62	1.21	-0.46	0.00	1
281	October 14, 2003	8:44:00 AM	14.61	13.78	1.29	-0.46	0.00	1
282	November 4, 2003	8:40:00 AM	14.35	13.49	1.31	-0.45	0.00	1
283	November 5, 2003	7:10:00 PM	14.14	13.46	1.13	-0.45	0.00	1
284	November 11, 2003	4:58:00 PM	14.13	13.46	1.12	-0.45	0.00	5
285	September 15, 2003	2:02:00 AM	14.61	13.70	1.36	-0.45	0.00	1
286	June 1, 2003	7:30:00 PM	14.40	13.70	1.15	-0.45	0.00	1
287	June 5, 2003	6:00:00 AM	14.61	13.84	1.22	-0.44	0.00	6
288	September 14, 2003	8:50:00 AM	14.85	13.77	1.52	-0.44	0.00	1
289	May 20, 2003	6:06:00 AM	14.79	13.72	1.50	-0.43	0.00	5
290	October 28, 2003	4:30:00 PM	14.60	13.73	1.30	-0.43	0.00	1
291	June 23, 2003	10:42:00 PM	14.61	13.77	1.27	-0.43	0.00	1
292	June 24, 2003	6:48:00 AM	14.61	13.77	1.27	-0.43	0.00	5
293	June 3, 2003	6:06:00 AM	14.84	13.94	1.33	-0.43	0.00	2
294	April 2, 2003	5:24:00 AM	14.90	13.87	1.46	-0.43	0.00	1
295	July 23, 2003	6:24:00 AM	15.62	14.37	1.67	-0.42	0.00	1
296	March 20, 2003	1:38:00 AM	14.86	13.62	1.66	-0.42	0.00	1
297	September 21, 2003	8:18:00 PM	15.38	13.84	1.96	-0.42	0.00	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
298	October 29, 2003	6:02:00 AM	14.37	13.54	1.24	-0.41	0.00	5
299	April 10, 2003	5:02:00 AM	14.59	13.73	1.27	-0.41	0.00	5
300	October 16, 2003	5:00:00 AM	14.37	13.60	1.18	-0.41	0.00	5
301	September 23, 2003	8:56:00 AM	15.32	13.99	1.74	-0.41	0.00	1
302	September 24, 2003	7:28:00 AM	15.33	13.99	1.74	-0.40	0.00	1
303	September 2, 2003	5:28:00 PM	14.54	13.71	1.22	-0.39	0.00	6
304	May 9, 2003	6:22:00 AM	14.41	13.61	1.19	-0.39	0.00	5
305	May 9, 2003	6:04:00 AM	14.42	13.61	1.19	-0.38	0.00	5
306	December 3, 2003	7:36:00 PM	14.56	13.61	1.33	-0.38	0.00	1
307	May 12, 2003	10:04:00 PM	14.61	13.67	1.31	-0.37	0.00	1
308	May 12, 2003	10:10:00 PM	14.61	13.67	1.31	-0.37	0.00	1
309	May 13, 2003	11:14:00 PM	14.61	13.62	1.36	-0.37	0.00	1
310	May 14, 2003	6:32:00 AM	14.61	13.62	1.36	-0.37	0.00	5
311	September 28, 2003	4:32:00 PM	14.84	13.99	1.21	-0.36	0.00	1
312	May 15, 2003	9:30:00 PM	14.60	13.68	1.28	-0.36	0.00	1
313	April 14, 2003	7:22:00 PM	14.66	13.76	1.26	-0.36	0.00	5
314	April 16, 2003	12:06:00 AM	14.38	13.55	1.18	-0.35	0.00	1
315	April 10, 2003	5:10:00 AM	14.66	13.73	1.27	-0.34	0.00	5
316	July 2, 2003	6:00:00 AM	14.85	13.76	1.43	-0.34	0.00	5
317	July 2, 2003	6:04:00 AM	14.85	13.76	1.43	-0.34	0.00	5
318	April 21, 2003	7:32:00 AM	14.84	13.88	1.29	-0.33	0.00	1
319	April 6, 2003	8:12:00 PM	14.37	13.53	1.17	-0.33	0.00	2
320	July 7, 2003	12:18:00 AM	14.84	13.94	1.23	-0.33	0.00	1
321	July 1, 2003	5:30:00 AM	14.61	13.65	1.28	-0.32	0.00	1
322	July 1, 2003	6:14:00 AM	14.61	13.65	1.28	-0.32	0.00	5
323	June 19, 2003	5:24:00 AM	15.08	13.90	1.50	-0.32	0.00	5
324	May 5, 2003	7:30:00 PM	14.61	13.72	1.21	-0.32	0.00	5
325	May 5, 2003	8:42:00 AM	14.61	13.72	1.21	-0.32	0.00	1
326	May 8, 2003	5:48:00 AM	14.80	13.83	1.28	-0.31	0.00	5
327	June 15, 2003	8:02:00 PM	14.64	13.78	1.17	-0.31	0.00	5
328	August 21, 2003	9:28:00 PM	15.32	13.63	1.99	-0.30	0.00	5
329	July 28, 2003	7:16:00 AM	14.60	13.77	1.13	-0.30	0.00	1
330	October 26, 2003	3:50:00 PM	14.60	13.49	1.40	-0.29	0.00	6

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
331	September 21, 2003	8:14:00 PM	15.51	13.84	1.96	-0.29	0.00	5
332	June 17, 2003	5:30:00 AM	14.61	13.73	1.16	-0.28	0.00	5
333	May 7, 2003	10:42:00 PM	14.83	13.83	1.28	-0.28	0.00	1
334	August 26, 2003	8:00:00 PM	14.84	13.60	1.52	-0.28	0.00	5
335	June 22, 2003	7:06:00 PM	14.84	13.83	1.28	-0.27	0.00	2
336	October 27, 2003	4:44:00 AM	14.37	13.40	1.24	-0.27	0.00	5
337	October 2, 2003	6:30:00 AM	14.61	13.77	1.11	-0.27	0.00	5
338	October 2, 2003	6:34:00 AM	14.61	13.77	1.11	-0.27	0.00	5
339	July 22, 2003	5:58:00 AM	15.13	13.91	1.49	-0.27	0.00	1
340	February 23, 2003	7:40:00 PM	15.52	13.83	1.96	-0.26	0.00	1
341	September 18, 2003	6:20:00 AM	14.37	13.55	1.08	-0.26	0.00	1
342	August 26, 2003	7:08:00 PM	15.03	13.83	1.46	-0.26	0.00	5
343	May 7, 2003	8:10:00 PM	14.85	13.83	1.28	-0.26	0.00	5
344	June 2, 2003	3:22:00 AM	14.84	13.67	1.43	-0.26	0.00	5
345	April 23, 2003	11:50:00 PM	14.61	13.70	1.17	-0.26	0.00	1
346	August 13, 2003	10:44:00 AM	14.64	13.72	1.18	-0.25	0.00	6
347	May 28, 2003	5:22:00 AM	14.61	13.64	1.22	-0.25	0.00	5
348	October 26, 2003	2:00:00 AM	14.37	13.32	1.30	-0.25	0.00	1
349	October 26, 2003	2:04:00 AM	14.37	13.32	1.30	-0.25	0.00	1
350	October 26, 2003	2:06:00 AM	14.37	13.32	1.30	-0.25	0.00	1
351	May 1, 2003	6:26:00 AM	14.84	13.72	1.37	-0.25	0.00	5
352	June 2, 2003	5:18:00 AM	14.85	13.67	1.43	-0.25	0.00	5
353	June 2, 2003	5:26:00 AM	14.85	13.67	1.43	-0.25	0.00	5
354	June 5, 2003	5:48:00 AM	15.32	13.98	1.59	-0.25	0.00	5
355	September 18, 2003	11:16:00 PM	14.61	13.60	1.26	-0.25	0.00	1
356	June 20, 2003	6:14:00 AM	16.32	13.99	2.58	-0.25	0.00	5
357	December 8, 2003	8:14:00 AM	14.35	13.44	1.16	-0.25	0.00	1
358	December 17, 2003	5:50:00 PM	14.41	13.42	1.24	-0.25	0.00	1
359	September 17, 2003	10:20:00 AM	15.56	13.87	1.94	-0.25	0.00	1
360	October 20, 2003	7:40:00 AM	14.37	13.57	1.04	-0.24	0.00	5
361	August 12, 2003	6:32:00 AM	14.60	13.73	1.11	-0.24	0.00	1
362	June 24, 2003	10:06:00 AM	14.85	13.75	1.34	-0.24	0.00	5
363	May 28, 2003	5:02:00 PM	14.84	13.85	1.23	-0.24	0.00	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
364	November 4, 2003	8:44:00 AM	14.56	13.49	1.31	-0.24	0.00	1
365	July 10, 2003	6:40:00 PM	14.82	13.91	1.15	-0.24	0.00	5
366	June 22, 2003	7:16:00 PM	14.88	13.83	1.28	-0.23	0.00	2
367	May 15, 2003	5:32:00 PM	14.83	13.81	1.25	-0.23	0.00	5
368	June 19, 2003	5:58:00 PM	14.78	13.90	1.11	-0.23	0.00	5
369	October 12, 2003	3:16:00 AM	14.61	13.62	1.21	-0.22	0.00	1
370	June 18, 2003	5:52:00 AM	14.85	13.79	1.28	-0.22	0.00	5
371	June 29, 2003	11:54:00 PM	14.84	13.71	1.34	-0.22	0.00	1
372	June 29, 2003	11:58:00 PM	14.84	13.71	1.34	-0.22	0.00	1
373	April 9, 2003	5:26:00 AM	15.04	13.66	1.59	-0.21	0.00	5
374	May 14, 2003	7:18:00 PM	14.84	13.73	1.32	-0.21	0.00	5
375	May 14, 2003	7:20:00 PM	14.84	13.73	1.32	-0.21	0.00	5
376	May 5, 2003	4:56:00 AM	15.09	13.70	1.60	-0.21	0.00	5
377	June 1, 2003	7:32:00 PM	14.64	13.70	1.15	-0.21	0.00	1
378	June 1, 2003	7:40:00 PM	14.64	13.70	1.15	-0.21	0.00	5
379	September 7, 2003	9:52:00 PM	14.78	13.82	1.16	-0.21	0.00	5
380	April 23, 2003	7:32:00 PM	14.85	13.80	1.25	-0.20	0.00	1
381	September 25, 2003	11:58:00 PM	14.85	13.82	1.23	-0.20	0.00	1
382	September 26, 2003	5:30:00 AM	14.85	13.82	1.23	-0.20	0.00	1
383	September 26, 2003	5:32:00 AM	14.85	13.82	1.23	-0.20	0.00	1
384	June 23, 2003	8:50:00 PM	14.84	13.77	1.27	-0.20	0.00	1
385	July 22, 2003	5:04:00 PM	15.13	14.07	1.26	-0.20	0.00	5
386	November 9, 2003	7:30:00 PM	14.37	13.40	1.16	-0.19	0.00	1
387	April 3, 2003	5:30:00 AM	14.85	13.68	1.36	-0.19	0.00	1
388	August 7, 2003	7:54:00 AM	14.85	13.77	1.27	-0.19	0.00	1
389	September 17, 2003	10:16:00 AM	15.62	13.87	1.94	-0.19	0.00	1
390	December 15, 2003	4:44:00 AM	14.33	13.39	1.12	-0.18	0.00	5
391	May 16, 2003	6:18:00 AM	14.79	13.68	1.28	-0.17	0.00	5
392	July 24, 2003	6:30:00 AM	15.08	13.89	1.36	-0.17	0.00	1
393	July 24, 2003	6:32:00 AM	15.08	13.89	1.36	-0.17	0.00	1
394	October 16, 2003	1:30:00 AM	14.61	13.60	1.18	-0.17	0.00	1
395	May 21, 2003	7:00:00 PM	15.02	13.84	1.35	-0.17	0.00	5
396	September 23, 2003	11:36:00 PM	15.57	13.99	1.74	-0.16	0.00	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
397	August 25, 2003	7:04:00 AM	14.85	13.66	1.34	-0.15	0.00	5
398	April 16, 2003	12:04:00 AM	14.59	13.55	1.18	-0.14	0.00	1
399	July 8, 2003	5:24:00 AM	14.84	13.82	1.16	-0.14	0.00	5
400	April 7, 2003	6:12:00 AM	14.56	13.53	1.17	-0.14	0.00	5
401	July 8, 2003	6:04:00 AM	14.85	13.82	1.16	-0.13	0.00	5
402	July 8, 2003	6:30:00 AM	14.85	13.82	1.16	-0.13	0.00	5
403	March 12, 2003	6:18:00 AM	15.04	13.77	1.40	-0.13	0.00	5
404	May 14, 2003	6:30:00 AM	14.85	13.62	1.36	-0.13	0.00	5
405	March 19, 2003	5:04:00 AM	14.56	13.51	1.18	-0.13	0.00	5
406	September 9, 2003	5:46:00 AM	15.09	13.81	1.41	-0.12	0.00	1
407	September 9, 2003	5:48:00 AM	15.09	13.81	1.41	-0.12	0.00	1
408	September 9, 2003	5:50:00 AM	15.09	13.81	1.41	-0.12	0.00	1
409	May 19, 2003	5:48:00 AM	14.59	13.65	1.06	-0.12	0.00	5
410	May 15, 2003	9:32:00 PM	14.84	13.68	1.28	-0.12	0.00	1
411	September 25, 2003	7:46:00 AM	15.09	13.99	1.21	-0.11	0.00	1
412	September 25, 2003	7:52:00 AM	15.09	13.99	1.21	-0.11	0.00	1
413	July 1, 2003	10:20:00 PM	15.08	13.76	1.43	-0.11	0.00	1
414	July 2, 2003	1:20:00 AM	15.08	13.76	1.43	-0.11	0.00	1
415	June 15, 2003	10:42:00 PM	14.84	13.78	1.17	-0.11	0.00	2
416	September 9, 2003	6:20:00 PM	15.27	13.90	1.48	-0.11	0.00	1
417	July 13, 2003	6:44:00 PM	14.88	13.91	1.07	-0.10	0.00	5
418	May 19, 2003	7:26:00 AM	14.61	13.65	1.06	-0.10	0.00	6
419	July 2, 2003	4:20:00 AM	15.09	13.76	1.43	-0.10	0.00	5
420	June 16, 2003	5:26:00 AM	14.85	13.78	1.17	-0.10	0.00	5
421	June 16, 2003	5:34:00 AM	14.85	13.78	1.17	-0.10	0.00	5
422	June 16, 2003	6:06:00 AM	14.85	13.78	1.17	-0.10	0.00	2
423	August 5, 2003	6:06:00 AM	14.61	13.57	1.13	-0.09	0.00	1
424	August 5, 2003	6:10:00 AM	14.61	13.57	1.13	-0.09	0.00	1
425	August 15, 2003	5:58:00 AM	14.79	13.75	1.13	-0.09	0.00	5
426	April 6, 2003	8:14:00 PM	14.61	13.53	1.17	-0.09	0.00	2
427	March 11, 2003	10:56:00 PM	15.08	13.77	1.40	-0.09	0.00	1
428	July 6, 2003	11:32:00 PM	15.08	13.94	1.23	-0.09	0.00	2
429	July 7, 2003	12:20:00 AM	15.08	13.94	1.23	-0.09	0.00	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
430	August 19, 2003	5:42:00 AM	15.08	13.86	1.31	-0.09	0.00	1
431	August 19, 2003	6:00:00 AM	15.08	13.86	1.31	-0.09	0.00	5
432	August 19, 2003	6:02:00 AM	15.08	13.86	1.31	-0.09	0.00	5
433	June 19, 2003	5:28:00 AM	15.32	13.90	1.50	-0.08	0.00	1
434	May 29, 2003	5:40:00 AM	14.84	13.76	1.16	-0.08	0.00	5
435	May 29, 2003	5:50:00 AM	14.84	13.76	1.16	-0.08	0.00	5
436	March 11, 2003	11:32:00 PM	15.09	13.77	1.40	-0.08	0.00	5
437	March 17, 2003	5:56:00 AM	15.53	13.77	1.83	-0.08	0.00	5
438	April 16, 2003	12:02:00 AM	14.66	13.55	1.18	-0.07	0.00	1
439	August 12, 2003	5:50:00 AM	14.78	13.73	1.11	-0.06	0.00	1
440	May 19, 2003	5:50:00 AM	14.65	13.65	1.06	-0.06	0.00	5
441	May 28, 2003	4:00:00 PM	15.02	13.85	1.23	-0.06	0.00	5
442	September 25, 2003	7:50:00 AM	15.14	13.99	1.21	-0.06	0.00	1
443	May 20, 2003	7:24:00 PM	14.84	13.70	1.20	-0.06	0.00	5
444	July 28, 2003	6:10:00 AM	14.84	13.77	1.13	-0.06	0.00	5
445	June 16, 2003	11:10:00 PM	14.84	13.73	1.16	-0.05	0.00	1
446	June 26, 2003	4:22:00 AM	14.61	13.53	1.13	-0.05	0.00	1
447	June 17, 2003	6:14:00 AM	14.85	13.73	1.16	-0.04	0.00	5
448	September 9, 2003	8:32:00 PM	14.84	13.73	1.15	-0.04	0.00	1
449	August 15, 2003	6:32:00 AM	14.84	13.75	1.13	-0.04	0.00	1
450	May 28, 2003	8:16:00 PM	14.88	13.76	1.16	-0.04	0.00	5
451	July 10, 2003	6:38:00 PM	15.02	13.91	1.15	-0.04	0.00	5
452	May 5, 2003	7:28:00 PM	14.89	13.72	1.21	-0.04	0.00	5
453	June 22, 2003	6:26:00 PM	15.08	13.83	1.28	-0.03	0.00	5
454	June 22, 2003	7:38:00 PM	15.08	13.83	1.28	-0.03	0.00	1
455	October 27, 2003	4:46:00 AM	14.61	13.40	1.24	-0.03	0.00	5
456	October 2, 2003	6:42:00 AM	14.85	13.77	1.11	-0.03	0.00	5
457	September 18, 2003	1:00:00 AM	14.61	13.55	1.08	-0.02	0.00	1
458	August 28, 2003	5:58:00 AM	14.85	13.72	1.15	-0.02	0.00	5
459	August 28, 2003	6:10:00 AM	14.85	13.72	1.15	-0.02	0.00	5
460	August 28, 2003	6:12:00 AM	14.85	13.72	1.15	-0.02	0.00	5
461	September 30, 2003	7:38:00 AM	15.09	13.75	1.36	-0.02	0.00	5
462	July 30, 2003	6:04:00 AM	15.08	13.84	1.26	-0.02	0.00	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
463	July 30, 2003	6:08:00 AM	15.08	13.84	1.26	-0.02	0.00	5
464	July 30, 2003	6:10:00 AM	15.08	13.84	1.26	-0.02	0.00	5
465	July 30, 2003	6:30:00 AM	15.08	13.84	1.26	-0.02	0.00	5
466	December 18, 2003	5:48:00 AM	14.56	13.40	1.18	-0.02	0.00	5
467	August 11, 2003	6:12:00 AM	14.89	13.69	1.22	-0.01	0.00	5
468	August 4, 2003	5:24:00 AM	14.85	13.64	1.22	-0.01	0.00	5
469	August 12, 2003	6:12:00 AM	14.83	13.73	1.11	-0.01	0.00	1
470	September 19, 2003	12:54:00 AM	14.85	13.60	1.26	-0.01	0.00	1
471	May 28, 2003	5:06:00 PM	15.07	13.85	1.23	-0.01	0.00	5
472	June 1, 2003	1:42:00 PM	14.84	13.70	1.15	-0.01	0.00	5
473	October 23, 2003	1:58:00 AM	14.90	13.62	1.29	-0.01	0.00	1
474	September 17, 2003	10:18:00 AM	15.80	13.87	1.94	-0.01	0.00	1
475	August 7, 2003	6:00:00 AM	14.85	13.59	1.26	0.00	0.00	1
476	August 7, 2003	6:20:00 AM	14.85	13.59	1.26	0.00	0.00	1
477	August 7, 2003	6:22:00 AM	14.85	13.59	1.26	0.00	0.00	1
478	August 7, 2003	6:46:00 AM	14.85	13.59	1.26	0.00	0.00	1
479	August 7, 2003	7:10:00 AM	14.85	13.59	1.26	0.00	0.00	1
480	April 17, 2003	7:06:00 PM	15.08	13.78	1.30	0.00	0.00	5
481	April 27, 2003	8:28:00 PM	14.83	13.68	1.15	0.00	0.00	5
482	August 21, 2003	5:34:00 AM	15.62	13.63	1.99	0.00	0.00	1
483	October 20, 2003	3:48:00 AM	14.61	13.57	1.04	0.00	0.00	1
484	September 17, 2003	6:34:00 AM	14.85	13.76	1.08	0.01	0.01	5
485	October 13, 2003	7:48:00 AM	14.65	13.59	1.05	0.01	0.01	5
486	April 28, 2003	6:06:00 AM	14.85	13.68	1.15	0.02	0.02	5
487	October 22, 2003	7:06:00 AM	14.61	13.54	1.05	0.02	0.02	5
488	June 3, 2003	10:36:00 PM	15.13	13.91	1.20	0.02	0.02	1
489	July 20, 2003	5:00:00 PM	15.13	13.86	1.25	0.03	0.03	5
490	May 14, 2003	7:14:00 PM	15.08	13.73	1.32	0.03	0.03	5
491	June 30, 2003	6:20:00 AM	15.09	13.71	1.34	0.03	0.03	5
492	April 23, 2003	7:38:00 PM	15.09	13.80	1.25	0.04	0.04	1
493	December 8, 2003	6:18:00 AM	14.66	13.55	1.07	0.04	0.04	5
494	September 26, 2003	12:02:00 AM	15.09	13.82	1.23	0.04	0.04	1
495	May 9, 2003	6:02:00 AM	14.84	13.61	1.19	0.04	0.04	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
496	June 23, 2003	10:28:00 PM	15.08	13.77	1.27	0.04	0.04	1
497	November 2, 2003	7:20:00 PM	14.90	13.51	1.35	0.04	0.04	1
498	November 4, 2003	8:42:00 AM	14.85	13.49	1.31	0.05	0.05	1
499	February 16, 2003	5:46:00 PM	14.61	13.42	1.14	0.05	0.05	6
500	April 23, 2003	5:58:00 AM	16.13	14.03	2.05	0.05	0.05	2
501	June 8, 2003	9:00:00 PM	16.11	14.03	2.03	0.05	0.05	5
502	July 16, 2003	5:54:00 AM	15.13	13.84	1.23	0.06	0.06	5
503	July 16, 2003	6:14:00 AM	15.13	13.84	1.23	0.06	0.06	5
504	July 9, 2003	6:12:00 AM	14.85	13.71	1.07	0.07	0.07	5
505	July 24, 2003	6:08:00 AM	15.32	13.89	1.36	0.07	0.07	1
506	June 15, 2003	7:58:00 PM	15.03	13.78	1.17	0.08	0.08	5
507	December 2, 2003	7:06:00 PM	14.85	13.47	1.29	0.09	0.09	5
508	April 23, 2003	7:36:00 PM	15.14	13.80	1.25	0.09	0.09	1
509	October 7, 2003	7:10:00 AM	15.04	13.84	1.10	0.10	0.10	1
510	July 8, 2003	12:32:00 AM	15.08	13.82	1.16	0.10	0.10	1
511	June 19, 2003	6:02:00 AM	15.51	13.90	1.50	0.11	0.11	2
512	October 6, 2003	7:40:00 AM	15.33	13.75	1.47	0.11	0.11	5
513	September 9, 2003	6:00:00 AM	15.33	13.81	1.41	0.12	0.12	5
514	October 30, 2003	7:50:00 AM	14.37	13.21	1.04	0.12	0.12	1
515	May 15, 2003	9:34:00 PM	15.08	13.68	1.28	0.12	0.12	1
516	May 18, 2003	8:22:00 PM	14.84	13.65	1.06	0.13	0.13	1
517	May 19, 2003	5:04:00 AM	14.84	13.65	1.06	0.13	0.13	5
518	August 4, 2003	11:08:00 PM	14.84	13.57	1.13	0.14	0.14	6
519	April 10, 2003	5:04:00 AM	15.14	13.73	1.27	0.14	0.14	5
520	July 1, 2003	5:02:00 PM	15.13	13.80	1.19	0.14	0.14	5
521	July 1, 2003	7:12:00 PM	15.13	13.80	1.19	0.14	0.14	5
522	June 16, 2003	6:04:00 AM	15.09	13.78	1.17	0.14	0.14	5
523	March 9, 2003	11:32:00 PM	15.28	13.55	1.59	0.14	0.14	2
524	July 1, 2003	12:16:00 AM	15.08	13.65	1.28	0.15	0.15	1
525	May 11, 2003	5:36:00 PM	14.84	13.62	1.07	0.15	0.15	5
526	July 6, 2003	11:36:00 PM	15.32	13.94	1.23	0.15	0.15	1
527	July 1, 2003	6:12:00 AM	15.09	13.65	1.28	0.16	0.16	5
528	October 2, 2003	6:32:00 AM	15.04	13.77	1.11	0.16	0.16	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
529	October 1, 2003	6:58:00 AM	15.09	13.74	1.19	0.16	0.16	1
530	May 29, 2003	5:38:00 AM	15.08	13.76	1.16	0.16	0.16	5
531	August 4, 2003	6:02:00 AM	15.03	13.64	1.22	0.17	0.17	5
532	October 8, 2003	9:14:00 AM	15.33	13.89	1.27	0.17	0.17	5
533	July 11, 2003	5:54:00 AM	15.08	13.78	1.13	0.17	0.17	1
534	July 11, 2003	6:04:00 AM	15.08	13.78	1.13	0.17	0.17	5
535	July 11, 2003	6:06:00 AM	15.08	13.78	1.13	0.17	0.17	5
536	July 11, 2003	7:10:00 AM	15.08	13.78	1.13	0.17	0.17	5
537	August 11, 2003	6:16:00 AM	15.08	13.69	1.22	0.18	0.18	5
538	June 16, 2003	11:06:00 PM	15.08	13.73	1.16	0.19	0.19	1
539	June 26, 2003	1:30:00 AM	14.85	13.53	1.13	0.19	0.19	1
540	June 26, 2003	5:10:00 AM	14.85	13.53	1.13	0.19	0.19	6
541	June 26, 2003	6:00:00 AM	14.85	13.53	1.13	0.19	0.19	5
542	October 21, 2003	12:52:00 PM	15.08	13.71	1.17	0.20	0.20	1
543	October 21, 2003	4:06:00 PM	15.08	13.71	1.17	0.20	0.20	1
544	June 17, 2003	6:10:00 AM	15.09	13.73	1.16	0.20	0.20	5
545	July 6, 2003	8:26:00 PM	15.37	13.94	1.23	0.20	0.20	2
546	October 22, 2003	5:30:00 AM	14.79	13.54	1.05	0.20	0.20	5
547	July 14, 2003	5:08:00 AM	15.08	13.75	1.13	0.20	0.20	5
548	July 14, 2003	5:22:00 AM	15.08	13.75	1.13	0.20	0.20	5
549	August 14, 2003	8:34:00 PM	15.08	13.75	1.13	0.20	0.20	1
550	October 7, 2003	6:50:00 AM	15.14	13.84	1.10	0.20	0.20	5
551	June 22, 2003	10:02:00 AM	15.32	13.83	1.28	0.21	0.21	5
552	September 10, 2003	6:10:00 AM	15.09	13.73	1.15	0.21	0.21	5
553	October 13, 2003	7:46:00 AM	14.85	13.59	1.05	0.21	0.21	5
554	October 13, 2003	7:50:00 AM	14.85	13.59	1.05	0.21	0.21	6
555	June 4, 2003	6:24:00 AM	15.32	13.91	1.20	0.21	0.21	5
556	August 4, 2003	7:26:00 AM	15.08	13.64	1.22	0.22	0.22	1
557	September 17, 2003	9:44:00 PM	14.85	13.55	1.08	0.22	0.22	1
558	August 28, 2003	1:00:00 AM	15.09	13.72	1.15	0.22	0.22	1
559	August 28, 2003	6:04:00 AM	15.09	13.72	1.15	0.22	0.22	1
560	September 30, 2003	7:34:00 AM	15.33	13.75	1.36	0.22	0.22	1
561	September 30, 2003	7:36:00 AM	15.33	13.75	1.36	0.22	0.22	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
562	September 30, 2003	7:40:00 AM	15.33	13.75	1.36	0.22	0.22	5
563	July 30, 2003	6:06:00 AM	15.32	13.84	1.26	0.22	0.22	1
564	August 24, 2003	4:48:00 PM	15.07	13.73	1.12	0.22	0.22	1
565	July 29, 2003	6:22:00 AM	15.32	13.91	1.19	0.23	0.23	5
566	July 29, 2003	6:46:00 AM	15.32	13.91	1.19	0.23	0.23	1
567	August 12, 2003	6:30:00 AM	15.07	13.73	1.11	0.23	0.23	1
568	September 19, 2003	12:52:00 AM	15.09	13.60	1.26	0.23	0.23	1
569	April 2, 2003	5:20:00 AM	15.57	13.87	1.46	0.24	0.24	1
570	April 27, 2003	8:30:00 PM	15.08	13.68	1.15	0.25	0.25	5
571	July 16, 2003	6:30:00 AM	15.32	13.84	1.23	0.25	0.25	1
572	October 22, 2003	5:32:00 AM	14.85	13.54	1.05	0.26	0.26	5
573	October 22, 2003	7:08:00 AM	14.85	13.54	1.05	0.26	0.26	5
574	June 29, 2003	11:52:00 PM	15.32	13.71	1.34	0.26	0.26	5
575	August 22, 2003	4:58:00 AM	15.08	13.59	1.21	0.28	0.28	5
576	May 5, 2003	6:12:00 AM	15.58	13.70	1.60	0.28	0.28	5
577	November 4, 2003	3:20:00 PM	15.09	13.49	1.31	0.29	0.29	1
578	August 11, 2003	10:20:00 PM	15.13	13.73	1.11	0.29	0.29	6
579	August 11, 2003	7:50:00 PM	15.13	13.73	1.11	0.29	0.29	5
580	July 8, 2003	10:30:00 PM	15.08	13.71	1.07	0.30	0.30	1
581	March 16, 2003	6:44:00 PM	15.28	13.77	1.21	0.30	0.30	5
582	July 9, 2003	6:14:00 AM	15.09	13.71	1.07	0.31	0.31	5
583	July 9, 2003	6:40:00 AM	15.09	13.71	1.07	0.31	0.31	5
584	September 7, 2003	10:14:00 AM	15.56	13.87	1.38	0.31	0.31	1
585	September 25, 2003	7:54:00 AM	15.52	13.99	1.21	0.32	0.32	1
586	December 10, 2003	3:30:00 AM	15.10	13.52	1.26	0.32	0.32	5
587	May 19, 2003	5:52:00 AM	15.04	13.65	1.06	0.33	0.33	5
588	October 30, 2003	1:28:00 AM	14.85	13.36	1.16	0.33	0.33	1
589	October 30, 2003	7:20:00 AM	14.85	13.36	1.16	0.33	0.33	1
590	October 30, 2003	7:30:00 AM	14.85	13.36	1.16	0.33	0.33	1
591	May 11, 2003	5:54:00 PM	15.03	13.62	1.07	0.34	0.34	5
592	July 8, 2003	12:30:00 AM	15.32	13.82	1.16	0.34	0.34	1
593	September 19, 2003	9:06:00 AM	15.33	13.78	1.21	0.34	0.34	1
594	June 11, 2003	5:52:00 PM	15.32	13.80	1.18	0.35	0.35	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
595	April 21, 2003	6:02:00 AM	15.52	13.88	1.29	0.35	0.35	2
596	September 25, 2003	9:34:00 AM	15.56	13.99	1.21	0.36	0.36	5
597	September 25, 2003	9:38:00 AM	15.56	13.99	1.21	0.36	0.36	5
598	April 29, 2003	10:56:00 PM	16.57	13.82	2.36	0.39	0.39	1
599	October 1, 2003	5:44:00 AM	15.33	13.74	1.19	0.40	0.40	5
600	October 1, 2003	6:02:00 AM	15.33	13.74	1.19	0.40	0.40	5
601	May 29, 2003	5:34:00 AM	15.32	13.76	1.16	0.40	0.40	5
602	May 8, 2003	12:54:00 AM	15.52	13.83	1.28	0.41	0.41	1
603	August 11, 2003	6:14:00 AM	15.32	13.69	1.22	0.42	0.42	5
604	October 26, 2003	2:02:00 AM	15.04	13.32	1.30	0.42	0.42	1
605	June 22, 2003	8:14:00 PM	21.48	14.16	6.90	0.42	0.42	1
606	August 12, 2003	5:42:00 AM	15.27	13.73	1.11	0.43	0.43	5
607	June 16, 2003	11:00:00 PM	15.32	13.73	1.16	0.43	0.43	5
608	June 26, 2003	5:46:00 AM	15.09	13.53	1.13	0.43	0.43	5
609	July 2, 2003	6:06:00 AM	15.63	13.76	1.43	0.44	0.44	5
610	August 21, 2003	6:12:00 AM	16.07	13.63	1.99	0.45	0.45	5
611	November 12, 2003	2:30:00 PM	16.77	14.66	1.66	0.45	0.45	5
612	August 19, 2003	6:18:00 AM	15.62	13.86	1.31	0.45	0.45	1
613	June 18, 2003	5:48:00 AM	15.52	13.79	1.28	0.45	0.45	1
614	December 18, 2003	5:46:00 AM	15.04	13.40	1.18	0.46	0.46	5
615	September 11, 2003	8:56:00 AM	15.33	13.57	1.30	0.46	0.46	1
616	August 4, 2003	6:00:00 AM	15.33	13.64	1.22	0.47	0.47	2
617	April 23, 2003	7:34:00 PM	15.52	13.80	1.25	0.47	0.47	5
618	December 3, 2003	9:00:00 PM	15.28	13.61	1.19	0.48	0.48	1
619	July 16, 2003	6:20:00 AM	15.56	13.84	1.23	0.49	0.49	5
620	September 28, 2003	3:22:00 AM	15.33	13.78	1.04	0.51	0.51	5
621	September 28, 2003	4:10:00 AM	15.33	13.78	1.04	0.51	0.51	1
622	July 29, 2003	7:28:00 AM	15.62	13.91	1.19	0.53	0.53	5
623	July 17, 2003	4:30:00 AM	15.32	13.72	1.07	0.53	0.53	5
624	April 13, 2003	1:44:00 PM	15.33	13.55	1.25	0.53	0.53	1
625	July 7, 2003	8:06:00 PM	15.51	13.82	1.16	0.53	0.53	5
626	April 29, 2003	5:52:00 PM	15.57	13.71	1.32	0.53	0.53	1
627	October 28, 2003	8:10:00 PM	15.32	13.54	1.24	0.54	0.54	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
628	June 24, 2003	10:24:00 PM	15.32	13.57	1.19	0.56	0.56	1
629	July 23, 2003	8:50:00 PM	15.81	13.89	1.36	0.56	0.56	5
630	September 26, 2003	12:00:00 AM	15.62	13.82	1.23	0.57	0.57	5
631	October 15, 2003	6:34:00 PM	15.56	13.82	1.17	0.57	0.57	1
632	October 30, 2003	2:42:00 AM	15.09	13.36	1.16	0.57	0.57	5
633	October 30, 2003	2:52:00 AM	15.09	13.36	1.16	0.57	0.57	5
634	October 30, 2003	7:26:00 AM	15.09	13.36	1.16	0.57	0.57	1
635	October 7, 2003	6:54:00 AM	15.52	13.84	1.10	0.58	0.58	1
636	July 7, 2003	9:30:00 PM	15.56	13.82	1.16	0.58	0.58	1
637	December 14, 2003	4:28:00 PM	16.12	14.08	1.45	0.59	0.59	1
638	September 25, 2003	9:36:00 AM	15.80	13.99	1.21	0.60	0.60	5
639	September 25, 2003	9:40:00 AM	15.80	13.99	1.21	0.60	0.60	5
640	November 6, 2003	6:14:00 AM	15.28	13.45	1.22	0.61	0.61	5
641	July 24, 2003	6:06:00 AM	15.87	13.89	1.36	0.62	0.62	5
642	October 22, 2003	7:08:00 PM	15.32	13.67	1.03	0.62	0.62	1
643	September 9, 2003	8:30:00 PM	15.51	13.73	1.15	0.63	0.63	1
644	June 30, 2003	10:32:00 PM	15.56	13.65	1.28	0.63	0.63	5
645	September 7, 2003	10:18:00 PM	15.62	13.82	1.16	0.63	0.63	5
646	April 20, 2003	8:42:00 PM	15.82	13.88	1.29	0.65	0.65	5
647	June 25, 2003	9:10:00 PM	15.32	13.53	1.13	0.66	0.66	1
648	August 11, 2003	6:10:00 AM	15.57	13.69	1.22	0.67	0.67	1
649	August 11, 2003	10:14:00 PM	15.51	13.73	1.11	0.67	0.67	5
650	August 5, 2003	5:50:00 AM	15.38	13.57	1.13	0.68	0.68	1
651	December 7, 2003	5:58:00 PM	15.52	13.59	1.24	0.69	0.69	5
652	August 28, 2003	6:00:00 AM	15.57	13.72	1.15	0.70	0.70	5
653	November 3, 2003	7:56:00 AM	15.39	13.51	1.17	0.71	0.71	5
654	December 8, 2003	5:48:00 AM	15.34	13.55	1.07	0.72	0.72	1
655	May 8, 2003	6:00:00 AM	15.83	13.83	1.28	0.72	0.72	5
656	May 1, 2003	6:18:00 AM	15.83	13.72	1.37	0.74	0.74	5
657	September 28, 2003	1:06:00 AM	15.56	13.78	1.04	0.74	0.74	5
658	September 28, 2003	1:10:00 AM	15.56	13.78	1.04	0.74	0.74	1
659	September 28, 2003	3:20:00 AM	15.57	13.78	1.04	0.75	0.75	1
660	June 1, 2003	7:28:00 PM	15.62	13.70	1.15	0.77	0.77	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
661	August 12, 2003	6:10:00 AM	15.62	13.73	1.11	0.78	0.78	5
662	July 8, 2003	11:34:00 PM	15.57	13.71	1.07	0.79	0.79	5
663	September 17, 2003	10:22:00 AM	16.60	13.87	1.94	0.79	0.79	5
664	December 14, 2003	4:20:00 PM	16.33	14.08	1.45	0.80	0.80	5
665	September 25, 2003	8:00:00 AM	16.00	13.99	1.21	0.80	0.80	1
666	October 29, 2003	9:26:00 PM	15.33	13.36	1.16	0.81	0.81	6
667	October 30, 2003	7:24:00 AM	15.33	13.36	1.16	0.81	0.81	1
668	September 19, 2003	9:20:00 AM	15.80	13.78	1.21	0.81	0.81	5
669	August 5, 2003	4:00:00 AM	15.52	13.57	1.13	0.82	0.82	5
670	August 5, 2003	6:16:00 AM	15.52	13.57	1.13	0.82	0.82	1
671	August 22, 2003	5:18:00 AM	15.62	13.59	1.21	0.82	0.82	1
672	May 4, 2003	9:20:00 PM	16.12	13.70	1.60	0.82	0.82	1
673	August 20, 2003	5:00:00 AM	17.05	14.48	1.73	0.84	0.84	5
674	September 7, 2003	3:44:00 PM	16.10	13.87	1.38	0.85	0.85	5
675	June 16, 2003	7:48:00 PM	15.81	13.78	1.17	0.86	0.86	5
676	August 5, 2003	6:00:00 AM	15.57	13.57	1.13	0.87	0.87	1
677	April 7, 2003	4:42:00 AM	15.58	13.53	1.17	0.88	0.88	1
678	June 1, 2003	2:26:00 PM	15.75	13.70	1.15	0.90	0.90	5
679	August 10, 2003	9:12:00 PM	15.81	13.69	1.22	0.91	0.91	5
680	July 21, 2003	9:40:00 PM	16.31	13.91	1.49	0.91	0.91	1
681	September 25, 2003	7:48:00 AM	16.11	13.99	1.21	0.91	0.91	1
682	August 15, 2003	6:36:00 AM	15.80	13.75	1.13	0.92	0.92	5
683	December 18, 2003	6:00:00 AM	15.53	13.40	1.18	0.95	0.95	5
684	December 18, 2003	6:02:00 AM	15.53	13.40	1.18	0.95	0.95	5
685	November 3, 2003	5:56:00 AM	15.83	13.48	1.40	0.95	0.95	5
686	July 10, 2003	9:36:00 PM	15.86	13.78	1.13	0.95	0.95	5
687	October 19, 2003	9:28:00 PM	15.56	13.57	1.04	0.95	0.95	1
688	June 4, 2003	7:34:00 AM	16.11	13.91	1.20	1.00	1.00	6
689	March 17, 2003	3:56:00 AM	16.61	13.77	1.83	1.00	1.00	5
690	May 28, 2003	7:00:00 PM	16.10	13.85	1.23	1.02	1.02	1
691	November 11, 2003	6:02:00 PM	15.63	13.46	1.12	1.05	1.05	5
692	April 9, 2003	5:30:00 AM	16.32	13.66	1.59	1.07	1.07	1
693	May 29, 2003	5:36:00 AM	16.04	13.76	1.16	1.12	1.12	5

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
694	December 16, 2003	8:30:00 PM	15.64	13.30	1.22	1.12	1.12	5
695	December 15, 2003	7:32:00 PM	15.64	13.29	1.19	1.16	1.16	5
696	July 11, 2003	5:48:00 AM	16.11	13.78	1.13	1.20	1.20	1
697	September 30, 2003	11:04:00 AM	16.28	13.82	1.24	1.22	1.22	1
698	May 21, 2003	7:02:00 PM	16.48	13.84	1.35	1.29	1.29	1
699	August 5, 2003	9:34:00 PM	16.24	13.64	1.29	1.31	1.31	5
700	August 22, 2003	5:06:00 AM	16.11	13.59	1.21	1.31	1.31	1
701	September 28, 2003	10:42:00 AM	16.52	13.99	1.21	1.32	1.32	5
702	July 13, 2003	2:30:00 PM	16.30	13.91	1.07	1.32	1.32	1
703	March 16, 2003	10:24:00 AM	16.30	13.77	1.21	1.32	1.32	5
704	July 23, 2003	8:54:00 PM	16.59	13.89	1.36	1.34	1.34	5
705	May 13, 2003	6:02:00 AM	16.32	13.67	1.31	1.34	1.34	5
706	July 14, 2003	5:30:00 AM	16.24	13.75	1.13	1.36	1.36	5
707	May 16, 2003	6:12:00 AM	16.32	13.68	1.28	1.36	1.36	5
708	March 12, 2003	6:08:00 AM	16.54	13.77	1.40	1.37	1.37	1
709	May 28, 2003	10:32:00 PM	16.31	13.76	1.16	1.39	1.39	6
710	July 6, 2003	11:34:00 PM	16.56	13.94	1.23	1.39	1.39	5
711	August 15, 2003	6:34:00 AM	16.28	13.75	1.13	1.40	1.40	5
712	May 21, 2003	7:04:00 PM	16.59	13.84	1.35	1.40	1.40	1
713	May 7, 2003	8:12:00 PM	16.52	13.83	1.28	1.41	1.41	5
714	July 24, 2003	6:14:00 AM	16.76	13.89	1.36	1.51	1.51	1
715	March 12, 2003	6:14:00 AM	16.77	13.77	1.40	1.60	1.60	1
716	May 6, 2003	8:12:00 PM	16.60	13.73	1.27	1.60	1.60	5
717	July 1, 2003	7:46:00 AM	16.60	13.80	1.19	1.61	1.61	1
718	May 7, 2003	8:18:00 PM	16.73	13.83	1.28	1.62	1.62	5
719	April 29, 2003	6:12:00 PM	16.76	13.71	1.32	1.72	1.72	1
720	September 28, 2003	3:52:00 PM	16.96	13.99	1.21	1.76	1.76	1
721	April 1, 2003	10:44:00 PM	17.10	13.87	1.46	1.77	1.77	5
722	April 28, 2003	2:16:00 AM	16.61	13.68	1.15	1.78	1.78	1
723	September 14, 2003	6:24:00 PM	17.08	13.77	1.52	1.79	1.79	5
724	September 29, 2003	5:44:00 AM	18.31	13.97	2.51	1.83	1.83	5
725	July 14, 2003	5:36:00 AM	16.72	13.75	1.13	1.84	1.84	1
726	April 1, 2003	2:14:00 PM	16.80	13.71	1.23	1.86	1.86	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
727	August 28, 2003	6:02:00 AM	16.73	13.72	1.15	1.86	1.86	5
728	June 30, 2003	10:30:00 PM	16.80	13.65	1.28	1.87	1.87	6
729	October 1, 2003	6:56:00 AM	16.81	13.74	1.19	1.88	1.88	5
730	May 21, 2003	6:00:00 AM	16.98	13.73	1.37	1.88	1.88	1
731	July 22, 2003	6:00:00 AM	17.30	13.91	1.49	1.90	1.90	1
732	June 17, 2003	5:48:00 AM	16.81	13.73	1.16	1.92	1.92	1
733	April 10, 2003	7:12:00 PM	17.05	13.73	1.38	1.94	1.94	5
734	May 12, 2003	10:00:00 PM	17.05	13.67	1.31	2.07	2.07	5
735	July 27, 2003	8:02:00 PM	16.99	13.77	1.13	2.09	2.09	5
736	November 25, 2003	5:02:00 AM	16.99	13.75	1.11	2.13	2.13	1
737	July 7, 2003	7:00:00 AM	17.33	13.94	1.23	2.16	2.16	5
738	May 5, 2003	6:10:00 AM	17.46	13.70	1.60	2.16	2.16	1
739	November 25, 2003	5:00:00 AM	17.03	13.75	1.11	2.17	2.17	1
740	July 9, 2003	6:10:00 AM	17.05	13.71	1.07	2.27	2.27	1
741	February 19, 2003	10:34:00 PM	17.56	13.90	1.38	2.28	2.28	1
742	August 22, 2003	7:42:00 AM	17.09	13.59	1.21	2.29	2.29	1
743	October 23, 2003	6:00:00 AM	17.22	13.62	1.29	2.31	2.31	5
744	September 19, 2003	9:18:00 AM	17.30	13.78	1.21	2.31	2.31	1
745	April 7, 2003	11:32:00 AM	16.97	13.56	1.08	2.33	2.33	1
746	October 8, 2003	6:20:00 AM	17.97	13.88	1.72	2.37	2.37	1
747	December 3, 2003	6:00:00 AM	17.10	13.46	1.26	2.38	2.38	1
748	May 8, 2003	1:58:00 PM	17.30	13.65	1.23	2.42	2.42	5
749	June 17, 2003	5:26:00 AM	17.33	13.73	1.16	2.44	2.44	5
750	September 19, 2003	9:08:00 AM	17.46	13.78	1.21	2.47	2.47	5
751	August 12, 2003	6:20:00 AM	17.33	13.73	1.11	2.49	2.49	5
752	May 1, 2003	6:04:00 AM	17.73	13.72	1.37	2.64	2.64	1
753	February 24, 2003	1:42:00 AM	17.71	13.85	1.17	2.69	2.69	1
754	November 3, 2003	5:46:00 AM	17.59	13.48	1.40	2.71	2.71	5
755	April 28, 2003	6:10:00 AM	17.58	13.68	1.15	2.75	2.75	1
756	December 14, 2003	5:14:00 AM	17.51	13.57	1.11	2.83	2.83	5
757	June 1, 2003	7:42:00 PM	17.79	13.70	1.15	2.94	2.94	5
758	August 2, 2003	8:42:00 PM	17.79	13.59	1.25	2.95	2.95	5
759	September 21, 2003	5:56:00 PM	17.93	13.90	1.07	2.96	2.96	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
760	April 8, 2003	5:38:00 PM	18.04	13.62	1.38	3.04	3.04	5
761	October 8, 2003	8:26:00 PM	18.55	13.89	1.54	3.12	3.12	5
762	August 11, 2003	5:28:00 AM	18.04	13.69	1.22	3.14	3.14	1
763	September 15, 2003	6:34:00 AM	18.31	13.70	1.36	3.25	3.25	1
764	October 15, 2003	7:48:00 AM	18.30	13.82	1.17	3.31	3.31	1
765	July 10, 2003	6:34:00 PM	18.42	13.91	1.15	3.36	3.36	5
766	August 15, 2003	6:30:00 AM	18.31	13.75	1.13	3.43	3.43	5
767	April 29, 2003	10:52:00 PM	19.64	13.82	2.36	3.46	3.46	5
768	April 17, 2003	5:36:00 AM	18.44	13.68	1.20	3.55	3.55	1
769	February 24, 2003	5:52:00 AM	18.69	13.85	1.17	3.67	3.67	1
770	October 15, 2003	7:50:00 AM	18.69	13.82	1.17	3.70	3.70	2
771	December 15, 2003	7:28:00 PM	18.20	13.29	1.19	3.72	3.72	5
772	September 12, 2003	6:28:00 AM	20.03	13.80	2.48	3.75	3.75	5
773	August 27, 2003	9:40:00 PM	18.78	13.72	1.15	3.91	3.91	5
774	April 23, 2003	5:12:00 AM	20.04	14.03	2.05	3.96	3.96	5
775	September 24, 2003	7:24:00 PM	19.15	13.97	1.14	4.04	4.04	2
776	August 5, 2003	6:18:00 AM	18.79	13.57	1.13	4.09	4.09	1
777	April 6, 2003	8:18:00 PM	19.04	13.53	1.17	4.34	4.34	1
778	October 29, 2003	7:06:00 AM	19.29	13.54	1.24	4.51	4.51	1
779	April 14, 2003	4:58:00 AM	20.86	13.61	2.66	4.59	4.59	5
780	December 10, 2003	7:44:00 PM	19.41	13.58	1.23	4.60	4.60	5
781	August 4, 2003	7:22:00 AM	19.53	13.64	1.22	4.67	4.67	1
782	March 17, 2003	6:06:00 AM	20.38	13.77	1.83	4.77	4.77	1
783	November 20, 2003	5:00:00 AM	19.55	13.46	1.25	4.84	4.84	5
784	August 19, 2003	4:06:00 AM	20.01	13.86	1.31	4.84	4.84	1
785	September 3, 2003	7:30:00 AM	20.02	13.66	1.29	5.07	5.07	5
786	July 15, 2003	5:52:00 AM	22.26	13.90	3.26	5.10	5.10	5
787	August 13, 2003	5:58:00 AM	20.02	13.68	1.14	5.20	5.20	1
788	June 24, 2003	7:24:00 AM	20.27	13.77	1.27	5.23	5.23	5
789	September 21, 2003	8:16:00 PM	21.33	13.84	1.96	5.53	5.53	5
790	July 24, 2003	7:48:00 AM	20.76	13.90	1.16	5.70	5.70	1
791	July 28, 2003	5:30:00 AM	20.60	13.77	1.13	5.70	5.70	5
792	October 20, 2003	1:00:00 PM	20.36	13.57	1.04	5.75	5.75	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
793	May 18, 2003	6:38:00 PM	20.84	13.80	1.20	5.84	5.84	1
794	November 6, 2003	3:06:00 AM	20.86	13.45	1.22	6.19	6.19	5
795	April 8, 2003	9:14:00 PM	21.76	13.66	1.59	6.51	6.51	5
796	July 17, 2003	5:38:00 AM	21.33	13.72	1.07	6.54	6.54	1
797	July 22, 2003	2:24:00 AM	22.45	13.91	1.49	7.05	7.05	5
798	November 20, 2003	4:58:00 AM	22.23	13.46	1.25	7.52	7.52	1
799	November 4, 2003	8:46:00 AM	22.57	13.49	1.31	7.77	7.77	1
800	May 12, 2003	6:26:00 PM	24.48	13.75	2.14	8.59	8.59	1
801	November 8, 2003	8:44:00 AM	23.48	13.50	1.25	8.73	8.73	1
802	May 18, 2003	6:40:00 PM	23.75	13.80	1.20	8.75	8.75	5
803	April 17, 2003	5:38:00 AM	23.72	13.68	1.20	8.83	8.83	2
804	May 1, 2003	3:02:00 AM	23.94	13.72	1.37	8.85	8.85	5
805	June 20, 2003	3:20:00 AM	25.46	13.99	2.58	8.89	8.89	1
806	December 15, 2003	7:30:00 PM	23.78	13.29	1.19	9.30	9.30	5
807	August 28, 2003	6:06:00 AM	24.49	13.72	1.15	9.62	9.62	6
808	June 23, 2003	6:12:00 PM	25.13	13.92	1.43	9.78	9.78	5
809	April 17, 2003	6:08:00 AM	24.68	13.68	1.20	9.79	9.79	1
810	June 15, 2003	9:34:00 AM	25.20	13.88	1.23	10.09	10.09	6
811	December 7, 2003	4:48:00 PM	25.22	13.59	1.24	10.39	10.39	1
812	February 18, 2003	6:30:00 AM	25.17	13.42	1.16	10.59	10.59	1
813	December 18, 2003	4:10:00 AM	25.23	13.40	1.18	10.65	10.65	1
814	May 5, 2003	3:24:00 AM	26.19	13.70	1.60	10.89	10.89	5
815	May 5, 2003	6:16:00 AM	28.03	13.70	1.60	12.73	12.73	1
816	April 7, 2003	5:30:00 AM	27.46	13.53	1.17	12.76	12.76	1
817	May 4, 2003	6:22:00 PM	28.81	13.73	1.93	13.15	13.15	2
818	April 9, 2003	5:28:00 AM	28.69	13.66	1.59	13.44	13.44	1
819	May 5, 2003	8:30:00 AM	28.37	13.72	1.21	13.44	13.44	5
820	April 13, 2003	1:48:00 PM	28.81	13.55	1.25	14.01	14.01	5
821	May 5, 2003	3:20:00 AM	29.55	13.70	1.60	14.25	14.25	2
822	February 23, 2003	7:24:00 PM	30.90	13.83	1.96	15.12	15.12	1
823	May 1, 2003	3:04:00 AM	30.29	13.72	1.37	15.20	15.20	1
824	May 5, 2003	8:36:00 AM	31.28	13.72	1.21	16.35	16.35	2
825	March 17, 2003	6:08:00 AM	32.59	13.77	1.83	16.98	16.98	1

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
826	October 12, 2003	3:46:00 PM	35.38	14.15	4.16	17.07	17.07	5
827	July 1, 2003	7:10:00 PM	33.18	13.80	1.19	18.19	18.19	5
828	October 9, 2003	5:04:00 AM	33.70	13.89	1.54	18.27	18.27	5
829	November 17, 2003	4:20:00 AM	36.40	13.74	4.08	18.58	18.58	6
830	July 22, 2003	5:52:00 AM	35.39	13.91	1.49	19.99	19.99	6
831	November 6, 2003	6:12:00 AM	35.18	13.45	1.22	20.51	20.51	6
832	August 10, 2003	1:00:00 PM	37.80	13.75	1.51	22.55	22.55	2
833	August 25, 2003	6:04:00 PM	38.78	13.84	2.00	22.94	22.94	2
834	October 6, 2003	1:24:00 AM	38.56	13.75	1.47	23.34	23.34	6
835	August 20, 2003	10:38:00 AM	45.64	13.97	7.01	24.66	24.66	6
836	May 4, 2003	3:04:00 PM	40.97	13.73	1.93	25.31	25.31	6
837	October 23, 2003	5:50:00 AM	43.96	13.62	1.29	29.05	29.05	1
838	September 4, 2003	4:50:00 AM	48.24	13.89	3.84	30.51	30.51	2
839	September 1, 2003	2:40:00 PM	48.80	13.96	3.15	31.69	31.69	6
840	July 24, 2003	6:04:00 AM	47.36	13.89	1.36	32.11	32.11	6
841	March 2, 2003	12:18:00 PM	47.87	13.54	2.00	32.33	32.33	6
842	March 31, 2003	2:12:00 AM	53.49	13.87	6.95	32.67	32.67	2
843	July 24, 2003	6:02:00 AM	50.18	13.89	1.36	34.93	34.93	6
844	March 9, 2003	10:38:00 AM	52.89	13.52	1.63	37.74	37.74	5
845	August 20, 2003	12:44:00 AM	54.92	14.48	1.73	38.71	38.71	6
846	October 26, 2003	6:22:00 PM	54.30	13.49	1.40	39.41	39.41	5
847	March 9, 2003	10:36:00 AM	55.12	13.52	1.63	39.97	39.97	6
848	August 11, 2003	1:48:00 AM	55.40	13.69	1.22	40.50	40.50	2
849	August 21, 2003	8:48:00 AM	56.14	13.65	1.93	40.56	40.56	6
850	August 20, 2003	5:02:00 PM	62.04	13.97	7.01	41.06	41.06	6
851	April 3, 2003	12:40:00 PM	57.14	13.67	1.86	41.61	41.61	6
852	October 19, 2003	5:50:00 PM	57.82	13.63	1.21	42.98	42.98	6
853	July 22, 2003	12:28:00 AM	58.56	13.91	1.49	43.16	43.16	6
854	September 6, 2003	9:02:00 PM	61.08	13.92	2.51	44.65	44.65	6
855	October 14, 2003	6:54:00 AM	62.28	13.85	3.57	44.86	44.86	6
856	September 14, 2003	3:02:00 PM	62.26	13.77	1.52	46.97	46.97	6
857	August 11, 2003	4:54:00 AM	62.00	13.69	1.22	47.10	47.10	6
858	August 10, 2003	12:04:00 PM	62.76	13.75	1.51	47.51	47.51	6

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
859	September 12, 2003	1:30:00 AM	67.17	13.80	2.48	50.89	50.89	6
860	December 14, 2003	4:54:00 PM	68.16	14.08	1.45	52.63	52.63	6
861	August 15, 2003	9:30:00 PM	68.34	13.63	1.22	53.49	53.49	2
862	November 9, 2003	6:30:00 AM	69.71	13.50	1.75	54.46	54.46	6
863	August 15, 2003	6:00:00 AM	71.00	13.75	1.13	56.12	56.12	2
864	October 18, 2003	4:14:00 PM	73.20	13.87	3.10	56.23	56.23	5
865	November 20, 2003	7:36:00 AM	71.3	13.46	1.25	56.59	56.59	5
866	July 27, 2003	5:58:00 PM	73.00	13.83	1.15	58.02	58.02	2
867	September 8, 2003	5:58:00 PM	76.60	13.96	3.35	59.29	59.29	6
868	October 14, 2003	7:32:00 AM	76.90	13.85	3.57	59.48	59.48	6
869	December 8, 2003	5:46:00 AM	74.70	13.55	1.07	60.08	60.08	6
870	November 17, 2003	1:30:00 AM	78.10	13.74	4.08	60.28	60.28	6
871	August 24, 2003	2:32:00 PM	75.80	13.73	1.12	60.95	60.95	1
872	September 11, 2003	6:56:00 AM	79.90	13.90	4.68	61.32	61.32	1
873	August 20, 2003	10:34:00 AM	82.40	13.97	7.01	61.42	61.42	1
874	August 21, 2003	6:46:00 AM	77.60	13.63	1.99	61.98	61.98	1
875	November 23, 2003	5:46:00 PM	77.20	13.15	1.16	62.89	62.89	1
876	September 22, 2003	9:28:00 AM	80.50	14.07	3.22	63.21	63.21	6
877	November 12, 2003	6:20:00 AM	79.60	13.55	1.35	64.70	64.70	6
878	November 10, 2003	2:06:00 AM	80.60	13.52	2.32	64.76	64.76	6
879	October 21, 2003	7:12:00 AM	82.80	13.75	2.77	66.28	66.28	6
880	September 21, 2003	5:58:00 PM	83.90	13.90	1.07	68.93	68.93	6
881	September 1, 2003	2:44:00 PM	87.10	13.96	3.15	69.99	69.99	6
882	September 29, 2003	5:38:00 AM	87.50	13.97	2.51	71.02	71.02	6
883	September 4, 2003	6:56:00 AM	90.50	13.89	3.84	72.77	72.77	1
884	September 2, 2003	6:32:00 AM	92.20	14.13	4.96	73.11	73.11	6
885	August 18, 2003	7:22:00 AM	93.70	14.19	5.25	74.26	74.26	6
886	November 25, 2003	5:08:00 AM	89.9	13.75	1.11	75.04	75.04	1
887	September 10, 2003	10:10:00 AM	95.30	14.19	5.72	75.39	75.39	6
888	August 26, 2003	5:58:00 AM	95.70	14.33	4.58	76.79	76.79	6
889	April 6, 2003	1:16:00 PM	93.80	13.68	1.25	78.87	78.87	6
890	September 9, 2003	7:50:00 AM	94.70	13.90	1.48	79.32	79.32	1
891	April 8, 2003	2:28:00 AM	94.10	13.42	1.04	79.64	79.64	6

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
892	October 12, 2003	2:28:00 PM	100.50	14.15	4.16	82.19	82.19	6
893	September 6, 2003	3:34:00 PM	100.80	13.93	3.53	83.34	83.34	6
894	April 3, 2003	3:38:00 AM	100.00	13.68	1.36	84.96	84.96	6
895	June 19, 2003	7:44:00 AM	100.80	13.90	1.50	85.40	85.40	6
896	September 3, 2003	6:18:00 AM	100.40	13.66	1.29	85.45	85.45	6
897	July 27, 2003	12:30:00 PM	100.80	13.83	1.15	85.82	85.82	6
898	September 2, 2003	7:20:00 AM	105.20	14.13	4.96	86.11	86.11	6
899	August 14, 2003	5:08:00 AM	107.70	13.81	4.23	89.66	89.66	6
900	April 8, 2003	2:24:00 AM	105.30	13.42	1.04	90.84	90.84	6
901	September 22, 2003	7:00:00 AM	107.40	13.84	1.96	91.60	91.60	2
902	September 10, 2003	9:36:00 PM	110.40	13.90	4.68	91.82	91.82	5
903	September 22, 2003	7:02:00 AM	111.30	13.84	1.96	95.50	95.50	6
904	November 13, 2003	4:36:00 AM	120.70	13.89	4.37	102.44	102.44	6
905	April 20, 2003	3:50:00 PM	126.20	13.93	4.28	107.99	107.99	1
906	April 13, 2003	12:56:00 AM	126.00	13.59	1.43	110.98	110.98	1
907	April 6, 2003	3:18:00 AM	129.00	13.70	1.50	113.80	113.80	6
908	May 21, 2003	2:58:00 PM	139.10	13.84	1.35	123.91	123.91	6
909	March 31, 2003	3:28:00 AM	146.00	13.87	6.95	125.18	125.18	5
910	August 13, 2003	10:46:00 AM	150.00	13.72	1.18	135.11	135.11	6
911	April 29, 2003	6:02:00 AM	173.90	13.75	1.37	158.78	158.78	6
912	August 26, 2003	7:32:00 AM	178.90	14.33	4.58	159.99	159.99	5
913	August 26, 2003	7:34:00 AM	183.30	14.33	4.58	164.39	164.39	1
914	September 3, 2003	4:42:00 AM	183.30	13.66	1.29	168.35	168.35	1
915	March 30, 2003	4:18:00 AM	192.40	13.62	8.17	170.61	170.61	1
916	August 11, 2003	4:46:00 AM	186.60	13.69	1.22	171.70	171.70	1
917	September 3, 2003	4:36:00 AM	197.10	13.66	1.29	182.15	182.15	1
918	May 21, 2003	3:06:00 PM	205.40	13.84	1.35	190.21	190.21	1
919	July 28, 2003	1:18:00 AM	220.80	13.77	1.13	205.90	205.90	6
920	September 9, 2003	3:22:00 AM	223.50	13.81	1.41	208.29	208.29	1
921	July 28, 2003	1:20:00 AM	223.40	13.77	1.13	208.50	208.50	1
922	April 17, 2003	2:34:00 AM	233.40	13.68	1.20	218.51	218.51	1
923	May 20, 2003	12:22:00 AM	248.10	13.72	1.50	232.88	232.88	6
924	June 29, 2003	10:54:00 PM	254.80	13.71	1.34	239.74	239.74	6

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
925	August 11, 2003	12:00:00 PM	256.40	13.85	1.23	241.33	241.33	1
926	August 11, 2003	11:58:00 AM	256.90	13.85	1.23	241.83	241.83	1
927	February 17, 2003	3:54:00 AM	262.40	13.44	1.46	247.50	247.50	1
928	May 15, 2003	7:26:00 PM	264.60	13.81	1.25	249.54	249.54	1
929	April 29, 2003	8:02:00 AM	266.20	13.71	1.32	251.16	251.16	6
930	June 19, 2003	6:00:00 AM	274.60	13.90	1.50	259.20	259.20	2
931	May 22, 2003	6:28:00 AM	276.50	13.72	1.75	261.03	261.03	5
932	August 30, 2003	10:40:00 AM	435.00	15.13	25.36	394.51	394.51	5
933	August 27, 2003	4:32:00 PM	470.10	15.13	28.15	426.82	426.82	6
934	August 11, 2003	1:58:00 PM	450.20	13.85	1.23	435.13	435.13	6
935	March 16, 2003	11:34:00 AM	459.10	13.77	1.21	444.12	444.12	6
936	October 27, 2003	9:40:00 AM	475.80	13.59	1.09	461.12	461.12	6
937	July 20, 2003	3:00:00 PM	496.20	13.86	1.25	481.10	481.10	6
938	April 3, 2003	8:12:00 AM	500.00	13.67	1.86	484.47	484.47	6
939	May 22, 2003	6:26:00 AM	500.00	13.72	1.75	484.53	484.53	6
940	March 30, 2003	12:10:00 PM	505.20	13.32	1.01	490.87	490.87	6
941	August 4, 2003	4:16:00 AM	514.40	13.64	1.22	499.54	499.54	6
942	August 10, 2003	9:52:00 AM	523.70	13.75	1.51	508.45	508.45	6
943	June 15, 2003	4:40:00 PM	528.00	13.88	1.23	512.89	512.89	6
944	April 6, 2003	11:08:00 AM	548.50	13.68	1.25	533.57	533.57	6
945	March 3, 2003	8:50:00 AM	569.90	13.76	1.23	554.90	554.90	6
946	August 17, 2003	2:00:00 PM	629.50	13.90	1.29	614.30	614.30	6
947	September 21, 2003	11:06:00 AM	643.70	13.90	1.07	628.73	628.73	6
948	April 6, 2003	11:14:00 AM	648.70	13.68	1.25	633.77	633.77	6
949	June 9, 2003	10:32:00 AM	694.10	13.80	1.06	679.24	679.24	6
950	October 28, 2003	8:34:00 AM	722.00	13.73	1.30	706.97	706.97	6
951	September 15, 2003	5:40:00 PM	738.00	13.85	1.44	722.70	722.70	6
952	October 19, 2003	10:40:00 AM	759.00	13.63	1.21	744.16	744.16	6
953	August 25, 2003	11:38:00 AM	763.00	13.84	2.00	747.16	747.16	6
954	February 18, 2003	1:28:00 PM	765.00	13.47	1.40	750.14	750.14	6
955	June 10, 2003	6:36:00 AM	1000.00	13.77	1.27	984.96	984.96	6
956	March 16, 2003	1:28:00 PM	1000.00	13.77	1.21	985.02	985.02	6
957	March 16, 2003	11:32:00 AM	1000.00	13.77	1.21	985.02	985.02	6

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
958	February 18, 2003	6:28:00 AM	1000.00	13.42	1.16	985.42	985.42	6
959	June 29, 2003	5:24:00 PM	1400.00	13.84	1.11	1385.05	1385.05	6
960	June 8, 2003	9:56:00 AM	1700.00	14.01	1.24	1684.75	1684.75	6
961	June 16, 2003	10:44:00 AM	1700.00	13.81	1.14	1685.05	1685.05	6
962	February 25, 2003	3:40:00 PM	1900.00	13.98	1.35	1884.67	1884.67	6
963	June 22, 2003	11:44:00 PM	2000.00	14.16	6.90	1978.94	1978.94	6
964	August 3, 2003	9:40:00 AM	2000.00	14.11	4.07	1981.81	1981.81	6
965	September 7, 2003	7:28:00 AM	2000.00	13.92	2.51	1983.57	1983.57	6
966	March 11, 2003	6:28:00 AM	2000.00	13.77	2.56	1983.67	1983.67	6
967	September 14, 2003	10:24:00 AM	2000.00	13.77	1.52	1984.71	1984.71	6
968	August 10, 2003	11:10:00 AM	2000.00	13.75	1.51	1984.75	1984.75	6
969	February 26, 2003	7:52:00 AM	2000.00	13.88	1.27	1984.85	1984.85	6
970	June 22, 2003	3:12:00 PM	2000.00	13.83	1.28	1984.89	1984.89	6
971	June 22, 2003	9:18:00 AM	2000.00	13.83	1.28	1984.89	1984.89	6
972	March 11, 2003	1:06:00 PM	2000.00	13.80	1.28	1984.92	1984.92	6
973	July 10, 2003	7:10:00 PM	2000.00	13.91	1.15	1984.94	1984.94	6
974	March 3, 2003	12:16:00 PM	2000.00	13.76	1.23	1985.00	1985.00	5
975	October 6, 2003	9:10:00 AM	2000.00	13.87	1.11	1985.02	1985.02	6
976	October 5, 2003	5:18:00 PM	2000.00	13.83	1.11	1985.06	1985.06	6
977	November 3, 2003	7:38:00 AM	2000.00	13.48	1.40	1985.12	1985.12	6
978	December 7, 2003	9:28:00 AM	2000.00	13.59	1.24	1985.17	1985.17	6
979	December 16, 2003	6:50:00 AM	2000.00	13.21	1.62	1985.17	1985.17	6
980	December 16, 2003	6:56:00 AM	2000.00	13.21	1.62	1985.17	1985.17	6
981	November 9, 2003	9:22:00 AM	2000.00	13.40	1.16	1985.44	1985.44	6
982	September 11, 2003	1:54:00 PM	2500.00	13.90	4.68	2481.42	2481.42	6
983	August 7, 2003	3:28:00 AM	2500.00	13.59	1.26	2485.15	2485.15	6
984	August 30, 2003	9:50:00 PM	2708.16	15.02	29.25	2663.89	2663.89	6
985	September 4, 2003	7:22:00 AM	2708.16	13.89	3.84	2690.43	2690.43	6
986	September 28, 2003	10:34:00 AM	2708.16	13.99	1.21	2692.96	2692.96	6
987	December 7, 2003	12:36:00 PM	2708.16	13.59	1.24	2693.33	2693.33	6
988	June 20, 2003	7:54:00 AM	3000.00	14.02	5.38	2980.60	2980.60	6
989	September 15, 2003	2:56:00 PM	3000.00	13.85	1.44	2984.70	2984.70	6
990	March 3, 2003	10:52:00 AM	3000.00	13.76	1.23	2985.00	2985.00	6

Record Number	Date of Shipment	Time of Shipment	Gross Value	Background Measurement	Standard Deviation	Net Exposure	Adjusted Net Exposure	Route Number
991	July 13, 2003	10:52:00 AM	3000.00	13.91	1.07	2985.02	2985.02	6
992	September 21, 2003	1:10:00 PM	3000.00	13.90	1.07	2985.03	2985.03	6
993	September 21, 2003	12:58:00 PM	3000.00	13.90	1.07	2985.03	2985.03	6
994	July 14, 2003	8:06:00 PM	3149.70	13.90	3.26	3132.54	3132.54	6
995	July 27, 2003	11:20:00 AM	3500.00	13.83	1.15	3485.02	3485.02	5
996	November 23, 2003	11:58:00 AM	3500.00	13.15	1.16	3485.69	3485.69	6
997	September 28, 2003	4:52:00 PM	4000.00	13.99	1.21	3984.80	3984.80	6
998	July 21, 2003	11:52:00 AM	4000.00	13.96	1.22	3984.81	3984.81	6
999	July 20, 2003	2:04:00 PM	4000.00	13.86	1.25	3984.90	3984.90	6
1000	July 20, 2003	6:04:00 PM	4000.00	13.86	1.25	3984.90	3984.90	6
1001	August 24, 2003	10:18:00 AM	4000.00	13.73	1.12	3985.15	3985.15	6
1002	August 24, 2003	6:52:00 PM	4000.00	13.73	1.12	3985.15	3985.15	6
1003	July 29, 2003	5:26:00 PM	4500.00	13.92	1.27	4484.81	4484.81	6
1004	July 29, 2003	5:30:00 PM	4500.00	13.92	1.27	4484.81	4484.81	6
1005	August 14, 2003	10:52:00 AM	4500.00	13.82	1.30	4484.87	4484.87	6
1006	September 9, 2003	5:32:00 PM	5000.00	13.90	1.48	4984.62	4984.62	6
1007	October 19, 2003	1:30:00 PM	5000.00	13.63	1.21	4985.16	4985.16	6
1008	August 29, 2003	10:32:00 AM	6500.00	13.71	1.14	6485.15	6485.15	6
1009	May 20, 2003	6:56:00 AM	7000.00	13.72	1.50	6984.78	6984.78	6
1010	May 26, 2003	9:56:00 PM	7000.00	13.81	1.28	6984.91	6984.91	6
1011	May 22, 2003	6:24:00 AM	10000.00	13.72	1.75	9984.53	9984.53	6
1012	April 8, 2003	2:16:00 AM	12000.00	14.76	14.31	11970.93	11970.93	6

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