

Transportation of Radioactive Material in Illinois

June 1980 - June 1981

State of Illinois
Department of Nuclear Safety

Prepared for
U.S. Nuclear Regulatory
Commission
and
U. S. Department of Transportation

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INTRODUCTION

The fourth year surveillance program was performed for the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Transportation (DOT) under Loan Agreement No. NRC-06-78-358. The purpose of the agreement was to continue the collaborative program between the State of Illinois, the NRC and the DOT for the surveillance of radioactive material in surface transport within the state. Information related to handling practices and the condition of packages, adherence to transportation regulations, and other pertinent data was acquired from vehicle inspections.

Maury Neuweg, Manager, Office of Radiation Safety, Illinois Department of Nuclear Safety (IDNS), acted as the state supervisor for the program, along with Corporal John Nordin, Coordination Supervisor, Division of Hazardous Materials, Department of Law Enforcement. J. Marty Simonin (IDNS) provided technical assistance and program coordination. Sixteen Illinois State Police troopers, well versed in hazardous materials and trained in the use of radiation detection equipment and pertinent DOT regulations, were the investigators and inspectors for the surveillance program. The data in this report consists of the information supplied by the state troopers, as a result of their activities in this program.

OBJECTIVES

The objectives of the surveillance program performed under the agreement were the following:

1. Evaluate a mechanism whereby law enforcement officers equipped with radiation detection instrumentation can monitor the surface transportation of radioactive materials in the State of Illinois and enforce the applicable regulations governing such transport.
2. Determine the level of compliance within the transportation system concerning the transport of radioactive material.
3. Categorize and analyze transportation data.
4. Correlate the level of compliance with the level of surveillance.

The objectives of the surveillance program have not changed during the past three years and are met to the extent of manpower availability. The only additional objective not mentioned above was the week-long concentrated study conducted at O'Hare International Airport, Chicago, to determine the magnitude of radioactive shipments within the area and level of compliance with the DOT regulations. See Appendix A for the results of this study.

OVERVIEW

The actual data collection for the surveillance program covered the period from June 6, 1980 to June 1, 1981. Surveillance personnel were located in fifteen districts throughout the state to cover the major interstate highways (see page 5 for locations).

The troopers utilized surveillance instrumentation (i.e., ionization chamber "cutie pie" and gamma scintillation detector with a portable radiation alarming monitor). Due to problems associated with the equipment's components (i.e., batteries, cables, etc.), the "down time" averaged 18% for all instruments in the districts, which is a 100% increase from last year's report.

Upon encountering a vehicle transporting radioactive material, through the use of the alarming rate meter (Eberline Model Rm-19) a state trooper would stop the vehicle and perform an inspection in accordance with the data sheet shown in Appendix C (page 48).

In addition to completing the Radioactive Material Vehicle Inspection Data Sheet, the state troopers performed the following evaluations:

1. Carrier documents were checked for shipper's certification papers, shipping name of nuclides, etc. and Transport Index. Placarding was checked and evaluated in accordance with applicable DOT regulations.
2. Package placement was examined for close proximity to occupied areas in the vehicle.
3. Package surveys were performed whenever possible, recording package markings, labels, shipping documents, and isotope and source activity.

Forms were not sufficiently completed by the state troopers 7% of the time due to other enforcement action taking precedence, other duties assigned, or instruments not functioning properly.

INSTRUMENTATION AND CALIBRATION

The following instruments were used in the surveillance program:

1. Fourteen Eberline Instrument Company "Cutie Pie" portable low-medium range ionization chambers, Model RO-3, with four linear scales ranging from 0-5 to 0-5,000 mR/hr. This instrument can be used to detect beta and gamma radiation;
2. One Searle Analytic radiation survey instrument, Model #2595;
3. One Nuclear Chicago Instrument Company "Cutie Pie" portable low-medium range ionization chamber, Model #2588, (this instrument is the property of the Illinois Department of Nuclear Safety due to loss of one RO-3 during the second contract year);
4. Seventeen Eberline Instrument Company portable alarming radiation detectors, Model RM-19, with four linear scales ranging from 0-500 to 0-500,000 counts per minute (CPM). The response time for this instrument is set at two seconds and the measurements are in gross CPM. Attached to the RM-19 is an Eberline Instrument Company Model SPA-3 gamma 2" x 2" sodium iodide thallium-activated scintillation detector with a sensitivity of 1.2×10^6 CPM per mR/hr with cesium-137.

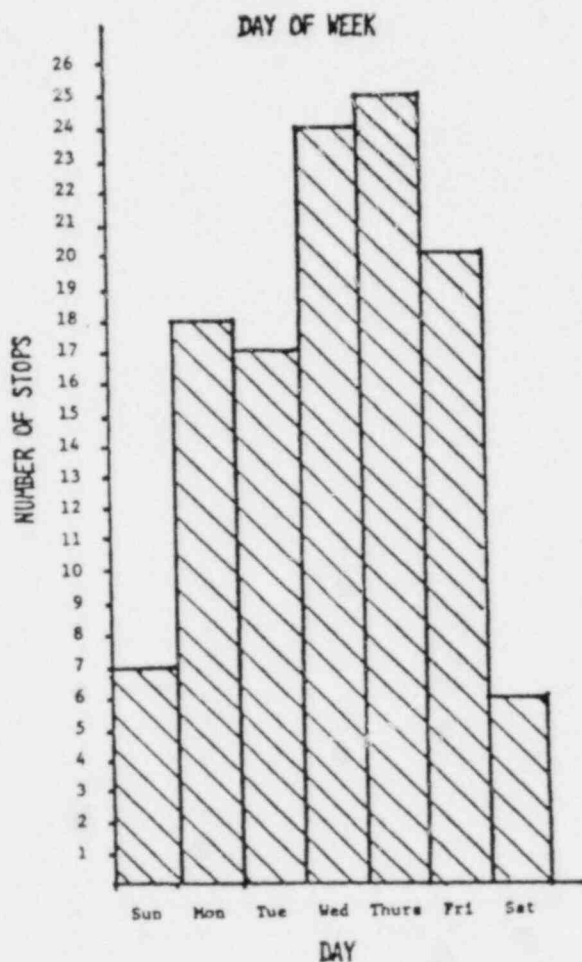
The RM-19s were calibrated by the Illinois Department of Nuclear Safety, using an Eberline minipulser, Model MP-1. The ionization chamber instruments were calibrated by the Illinois Department of Nuclear Safety using a radium-226

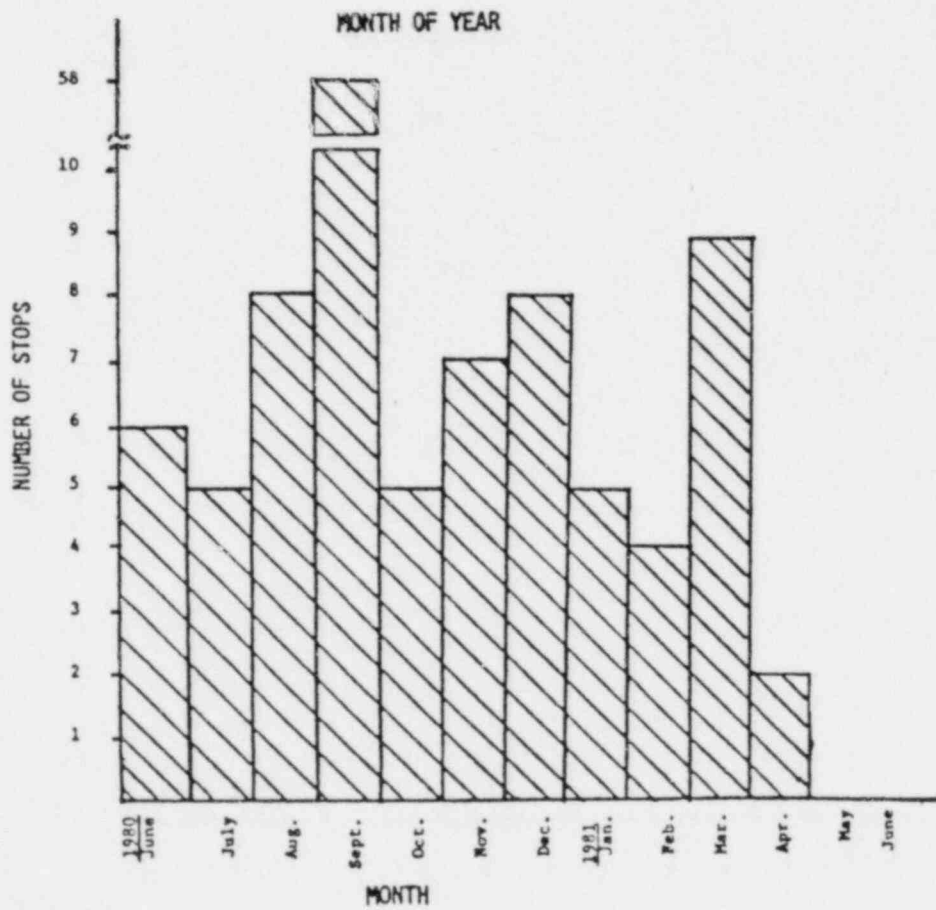
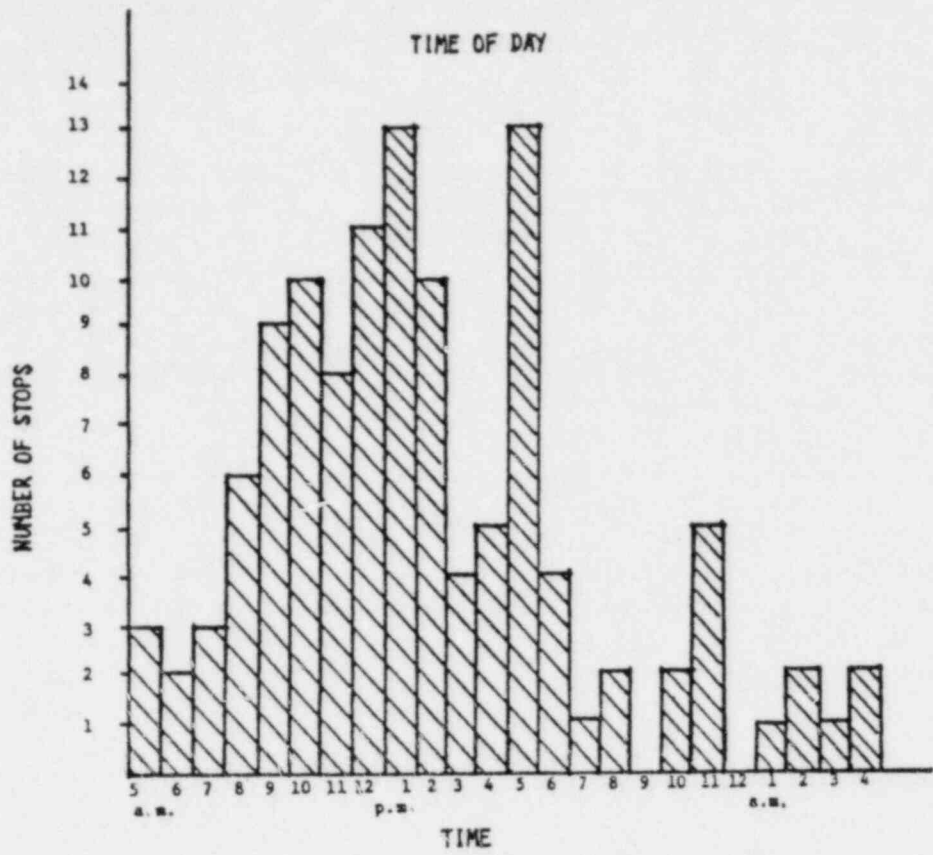
source with an activity of 14.45 millicuries. Calibrations were performed on June 6, 1980, October 27, 1980, January 16, 1981, and April 16, 1981.

SURVEY RESULTS

During the surveillance period from June 6, 1980 to June 1, 1981, the state troopers stopped 117 vehicles; fifty (50) of these stops were made during the O'Hare study (see Appendix B). The surveillance stops resulted in forty (40) "Notices of Apparent Violation" (NAV) being issued due to lack of proper placarding, shipping papers, and package labeling; radioactive material packages not properly blocked and braced; total Transport Index in excess of fifty (50); and improper package placement within the vehicle resulting in radiation levels greater than 2 mR/hr in the cab area.

The following graphs show the day of the week, the time of day the stops occurred, and the number of stops during each month. Forty-one percent of all inspections occurred in the morning. This data, however, may not necessarily reflect actual transportation patterns since only limited surveillance coverage was maintained. The time of day the stops occurred is misleading due to the O'Hare study. During the months of May and June, 1981, the surveillance involvement by the state troopers was negligible due to other priorities being assigned. (See Appendix D for data covering the four-year surveillance period.)



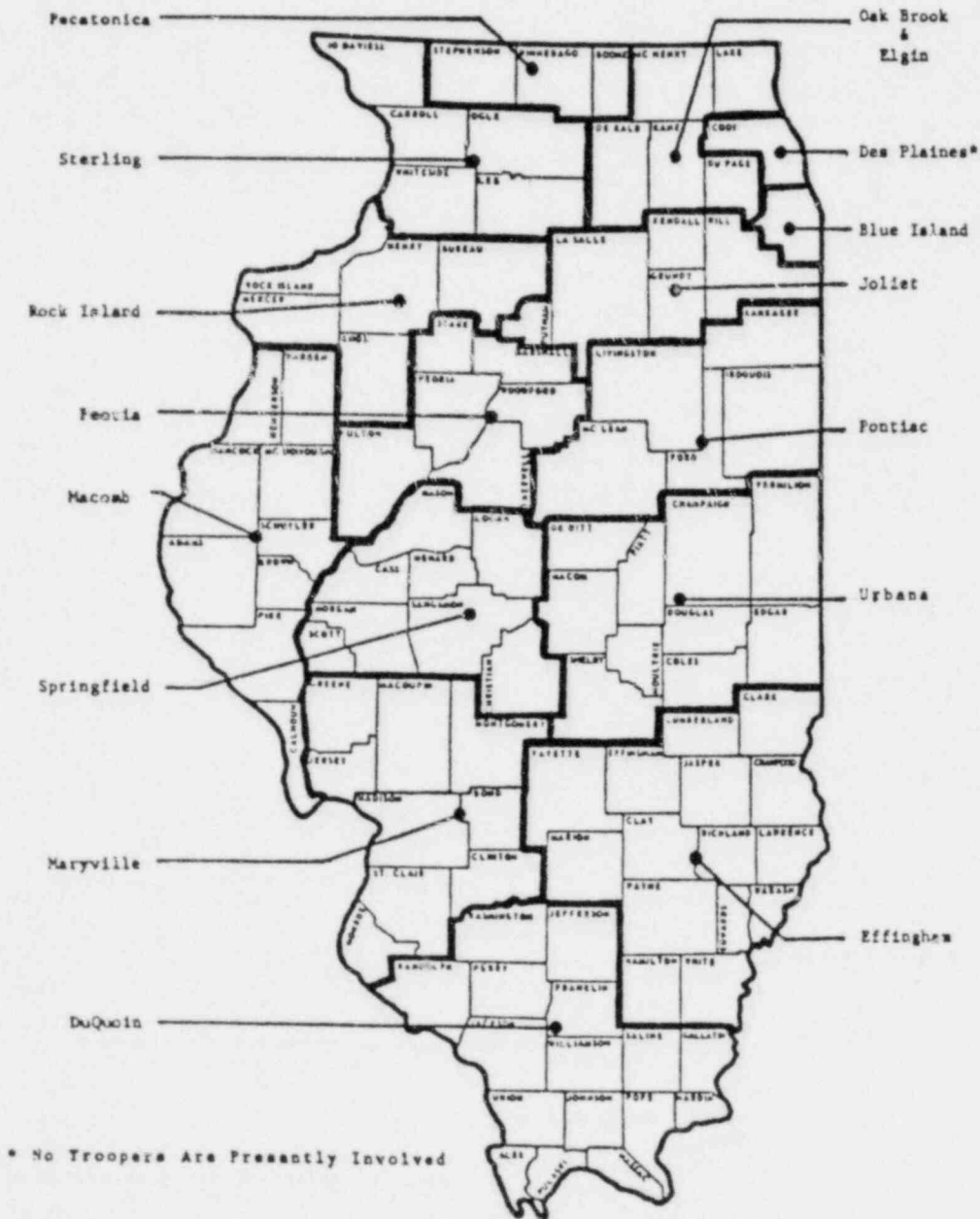


LOCATION OF SURVEILLANCE PERSONNEL

The state troopers normally only patrolled the interstate highways, yet 30% of the inspections occurred along intrastate routes or in cities during this contract year. Each district had only one trooper involved in surveillance activities, except Joliet, which had two individuals.

The following map shows the location of all sixteen (16) state police districts and the associated counties within the districts, giving a better perspective of their location within the state. Refer to Appendix A to observe the surveillance inspections conducted in each district.

STATE OF ILLINOIS
STATE POLICE DISTRICTS



VEHICLE RESULTS

The following vehicle types were noted during the surveillance stops: 3 passenger cars and 2 station wagons used for transporting radiopharmaceuticals; 48 semi-trailer vehicles used for radioactive waste LSA fuel-cycle material, radiopharmaceuticals, and industrial devices (i.e., moisture-density gauges); 22 straight trucks used for transporting radioactive waste, industrial devices (i.e., oil well-logging sources), LSA fuel-cycle material, and radiopharmaceuticals; 14 pick-up vehicles used to transport industrial radiography gamma cameras, moisture-density gauges and radiopharmaceuticals; 26 van-type vehicles used for transporting radiopharmaceuticals and industrial devices (i.e., radiography gamma camera); and 2 double bottom vehicles used for the shipment of moisture-density gauges and LSA fuel-cycle material.

The carriers involved in the surveillance stops were of the following categories: 26 contract carriers transporting 1,026 packages, 23 private carriers transporting 53 packages, and 68 common carriers transporting 1,441 packages.

The following table indicates the percent of carrier category types by contract year since initiation of this study in 1977. It is noted that the number of common carriers transporting radioactive material is increasing and the number of private carriers is decreasing within the state. The number of contract carriers and exclusive use vehicles have decreased from the 1979-1980 contract year to the 1980-1981 contract year.

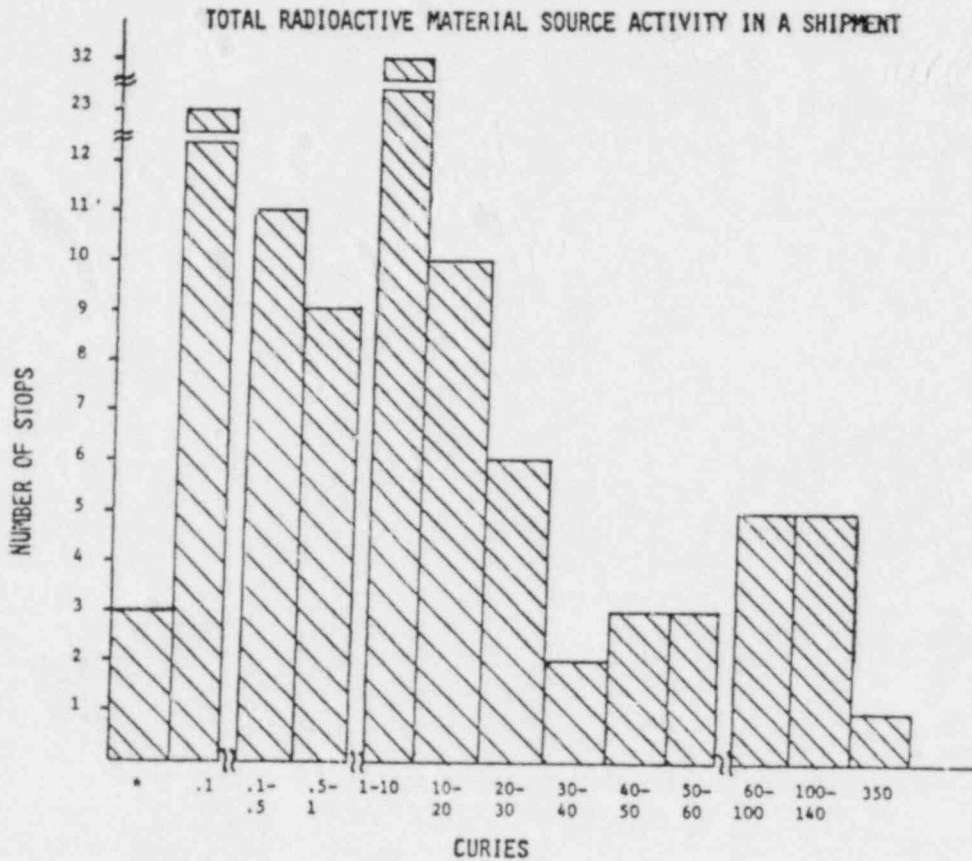
CARRIER CATEGORIES

Contract Year	Contract	Private	Common	Total Stops	Exclusive Use
'77-'78	25.0%	45.0%	30.0%	51	76%
'78-'79	33.3%	33.3%	33.3%	51	63%
'79-'80	40.0%	17.0%	43.0%	84	68%
'80-'81	22.0%	20.0%	58.0%	117	50%
TOTAL	89(29%)	78(26%)	136(45%)	303(100%)	194(64%)

The normal physical form (i.e., gas, liquid, solid) in which the radioactive material shipments occurred was solid for 70 surveillance stops, 21 liquid radiopharmaceutical shipments, 25 mixtures (i.e., gas, liquid and/or solid) radiopharmaceutical shipments, and 1 gas radiopharmaceutical shipment. (See Appendix E for a listing of the normal physical form of the radioactive material in the shipments by year.)

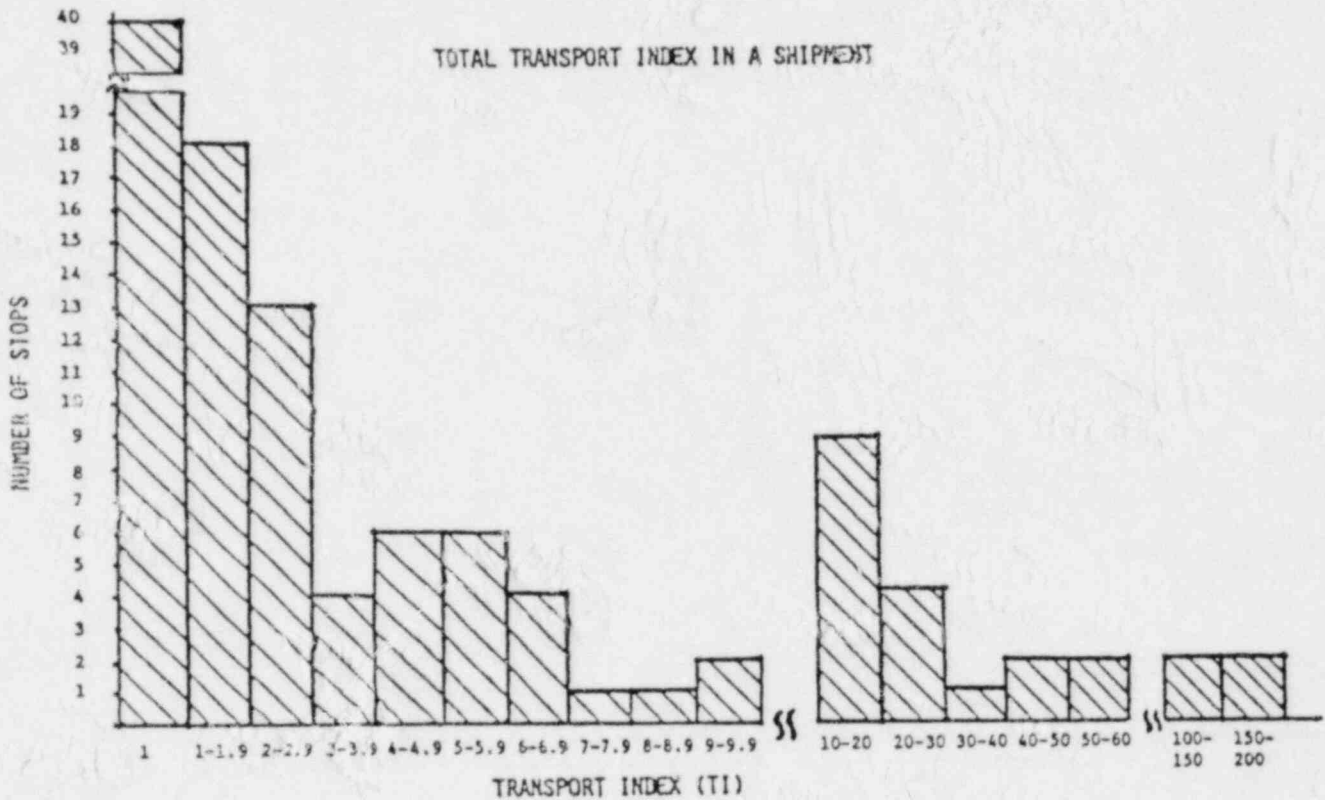
Twenty-seven shipments contained radioactive material in special form; of these, 11 were industrial radiography gamma cameras, 3 radiopharmaceutical shipments, 7 industrial devices (i.e., well logging, etc.), 3 LSA fuel-cycle shipments, and 3 moisture-density gauges containing radium.

The average total activity for the radioactive materials, being transported by 110 vehicles, was 19.202 curies per shipment. The troopers were not able to determine the total radioactive source activity in 3 vehicles; two were radio-pharmaceuticals in a straight truck and a pick-up, and the other was an industrial device being transported in a semi-trailer. The total radioactive source activity on each vehicle ranged from 0.1 microcuries to a molybdenum-99 generator of 350 curies. The average gross weight for 4 shipments of LSA radioactive material, natural uranium, was 32,180 lbs. The graph below indicates the number of stops and the total radioactive material source activity present per shipment.



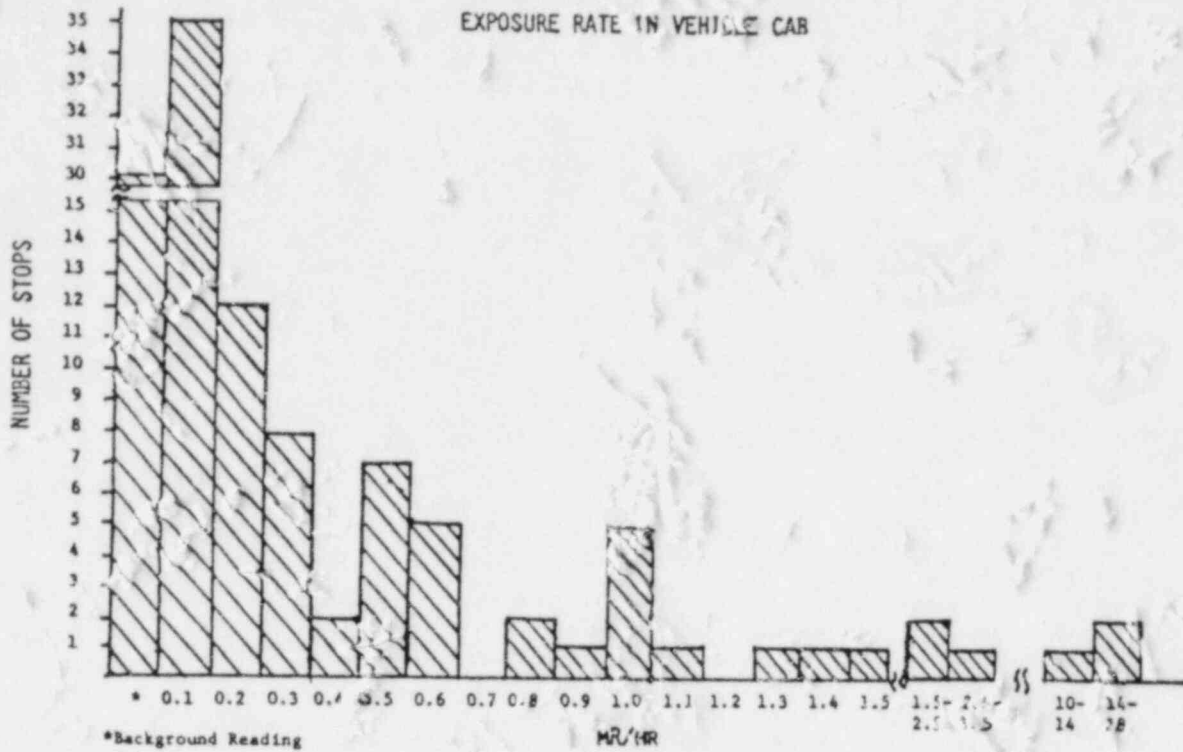
*No source activity indicated on report form

The average total Transport Index (TI) indicated on shipping papers and/or determined by the state troopers was 13.15 for 98 surveillance stops, ranging from 0.1 to 189.8. The other 19 stops involved vehicles transporting either White I labeled packages or packages not requiring labels. (See Appendix F for a listing by year of the TI, and radiation monitoring results.) The graph below indicates the frequency distribution of total TI in a shipment and the number of stops.

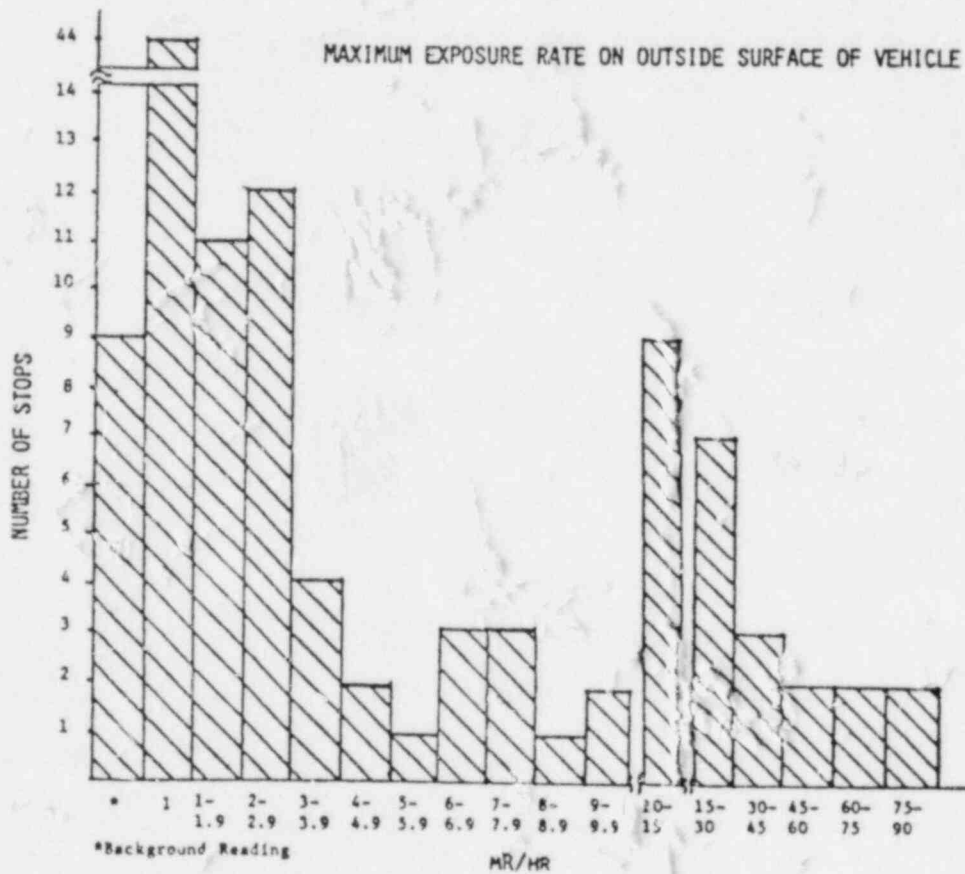


MONITORING RESULTS

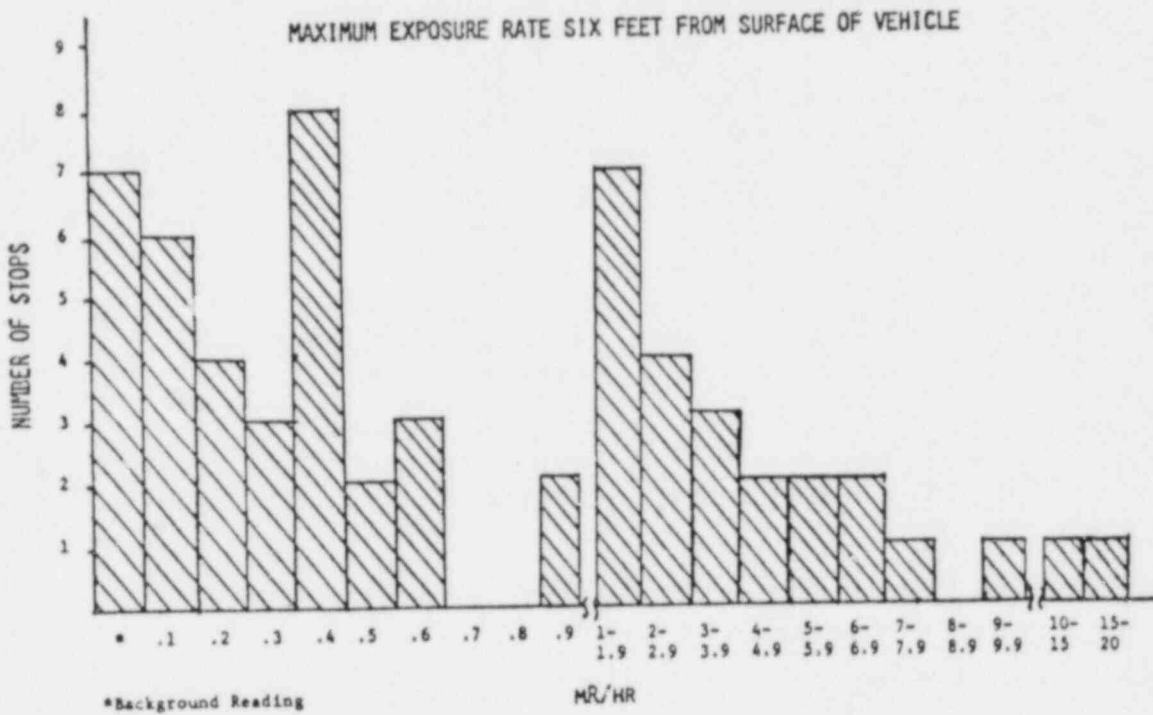
The cab areas of the vehicles were monitored with the RO-3 ionization chamber survey instrument. The average result for the normally occupied area within the vehicles was 0.67 mR/hr for all of the vehicles stopped, ranging from background to 17.0 mR/hr. There were 3 shipments in which the radiation levels in the cab area were 11.0, 14.0, and 17.0 mR/hr; all 3 were radiopharmaceutical shipments where the packages were too close to the cab. Upon proper separation of the packages, the radiation level was reduced to less than 2.0 mR/hr. (See Appendix F for a listing by date of the carrier and the radiation levels associated with their shipments.)



The outside surfaces of the 117 vehicles stopped had an average maximum level of 7.65 mR/hr, with a range from background to 80 mR/hr.



The average maximum radiation level at six feet from the surface of the vehicle was 1.748 mR/hr for 59 vehicles. The radiation levels ranged from background to 18.0 mR/hr. The 18.0 mR/hr radiation level reading was obtained from a vehicle with a 188.1 total Transport Index. Since the 58 other vehicles were non-exclusive use, vehicles' six-foot radiation level readings were not taken. The graph below indicates the number of surveillance stops occurring and the related maximum exposure rate at six feet from the vehicle's surface.



DOT NON-COMPLIANCE ITEMS AND EXCEPTIONS

Shipping papers and a shipper's certification were the frequent items found in non-compliance with DOT regulations, along with an occasional Transport Index omitted from the shipping papers and/or shipping labels. There were 40 vehicles, 34% of all stops, in which Notices of Apparent Violation (NAV) were issued.

Improper placarding involved 10 vehicles, which were issued NAV warning citations by the troopers. In these instances, the vehicles either did not have the sufficient number of placards or had none at all.

A comparison of the last four years surveillance reports indicates a high correlation of number of NAVs issued to the number of inspections occurring. As the number of surveillance stops increased, the number of NAVs proportionately increased. Thirty-eight percent of the NAVs contained between two and seven separate DOT regulation violations during this contract year.

The following data were listed on the Radiation Surveillance Stops Report in Appendix A by number, explaining the DOT non-compliance items and unique circumstances found during the trooper's investigations:

1. Improperly prepared shipping papers (i.e., radioactive material nuclide not indicated, Transport Index of packages missing, chemical and physical form of radioactive material not indicated).
2. Improperly prepared shipping papers (i.e., radioactive material nuclide not indicated, Transport Index of packages missing, chemical and physical form of radioactive material not indicated).
3. Improperly prepared shipping papers (i.e., radioactive material nuclide not indicated, Transport Index of packages missing, chemical and physical form of radioactive material not indicated).
4. Shipping papers were not readily available.
5. Radiation level of 17 mR/hr at driver's seat. This was reduced to less than 2 mR/hr by shifting the packages to the rear of the vehicle.
6. Shipping papers had improper shipping name and quantity of each isotope, and lacked hazard class, Transport Index, or package label category. Radiopharmaceutical packages were not blocked or braced (e.g., when driver opened rear door, four boxes of Yellow II and III's fell out of the rear onto the trooper).
7. Shipping papers were inaccessible (attached to box in rear of van) and illegible. Total Transport Index for shipment was 57.2 which was in excess of the 50.0 limit for the type of radiopharmaceutical packages present.
8. No shipping papers available for the industrial radiography gamma camera source. The radiography camera did not have any Yellow II labels on it nor was the camera properly secured within the vehicle.

9. Proper shipping papers were not readily available. The carrier was stopped after just receiving radiopharmaceutical packages at one of the cargo terminals at O'Hare.
10. Vehicle was not placarded while transporting Yellow III radiopharmaceutical packages. Packages were not blocked and braced. Labels (i.e., Yellow III) on empty boxes were not properly defaced. Driver marked the labels with a marking pen during the surveillance stop.
11. Vehicle was not placarded.
12. Overpacks had mixtures of Yellow II, White I, and limited packages in the boxes. The shipping labels attached to the overpacks were not properly completed (i.e., total curies, total TI, etc.).
13. Placards displayed on vehicle when only White I packages were being transported. This is not in violation with DOT regulations, but if continued and a vehicle accident would occur, responding personnel to the accident might overreact. Shipping papers did not identify the isotope nor the source activity in curies.
14. Shipping papers did not properly list the name of the radionuclide nor the shipper or consignee. Vehicle was not placarded even though the radioactive material package had a Yellow III label. The package was surveyed with an ionization chamber survey instrument and at that time, a White I label was sufficient.
15. Vehicle was not placarded. Shipper's certification was not on shipping papers. Empty packages on the vehicle had Yellow III labels that were not defaced.
16. Radiopharmaceutical packages had Yellow III labels although the Transport Index listed on the label and the Transport Index determined by the trooper indicated the label should have been Yellow II.
17. Radionuclide was not listed on Yellow II label and labels were placed only on one side of the package.
18. Radioactive material package was not braced and blocked.
19. Vehicle was not placarded when package had a Yellow III label. Package was overlabeled containing isotopes with a decay half life greater than one year, when Transport Index was determined by the trooper to be 0.4, requiring only a Yellow II label. Improper shipping name on the shipping papers. The papers were taped to the package, and thus not readily available.
20. Shipping papers were illegible and proper shipping name was not on package. Radiopharmaceuticals were not in a specification container.
21. Vehicle was not placarded. Package was not braced and blocked. Both rear doors on the vehicle open with the package on a skid.
22. The total Transport Index for the vehicle was 132.3 exceeding a total TI of 50 for the type of packages present. Packages were overlabeled when Transport Index on the Yellow III label was stated to be 0.9 and the trooper determined it to be 0.5, requiring only a Yellow II label.

23. Vehicle was not placarded. The radiation levels at the driver's seat was 10.0 mR/hr and after shifting the packages, the level was lowered to less than 2 mR/hr.
24. The total Transport Index was 188.1 exceeding a total TI of 50 for the type of radiopharmaceutical packages present.
25. No shipping papers; label missing or not properly completed (i.e., isotope, activity and TI).
26. No shipping papers; label missing or not properly completed (i.e., isotope, activity and TI).
27. Radioactive material packages not secured resulted in one of two radiopharmaceutical packages transported by a carrier being lost along the highway. The lost package was located and recovered by a hazardous material trooper through the use of his surveillance instruments.
28. Radiation levels were greater than 2 mR/hr in the cab of a vehicle in addition to 2 placards missing from the vehicle. The radiation level was 11 mR/hr and the driver had already driven the vehicle for several hours making deliveries before the stop occurred. This surveillance stop included radiopharmaceutical shipments to various hospitals in the northern section of Illinois and southern parts of Wisconsin. The packages were shifted to the rear of the vehicle lowering the radiation level to less than 2 mR/hr in the cab area.
29. A radiopharmaceutical shipment had papers indicating it was an exclusive use vehicle (see Appendix H) and the total TI was 189.8. The radiation level was 18 mR/hr at six feet from the vehicle surface and the packages were not blocked and braced. The total TI exceeds 50 for the type of radiopharmaceutical packages present.
30. Total TI exceeded 50 for the type of radiopharmaceutical packages present.
31. A radiopharmaceutical shipment with a total TI of 45.1 was being transported in a pick-up where the radiation level in the cab area was 14 mR/hr. The packages were redistributed, lowering the radiation level to less than 2.0 mR/hr.
32. The shipping papers for an industrial cesium-137 isotope gauge failed to list the source activity in curies.
33. An industrial radiographer failed to have shipping papers in the vehicle, and the vehicle's rear placard was missing.
34. A radiopharmaceutical shipment had a total TI of 59.3, exceeding the limit of 50 even though the vehicle was indicated to be exclusive use. The radiation level in the van's cab was 3.7 mR/hr with the packages near the rear of the vehicle. The total TI exceeds 50 for the type of radiopharmaceutical packages present.
35. A vehicle transporting an LSA shipment was cited for missing a front placard. The shipping papers stated that all four placards were present when leaving the cargo terminal.

36. A radiopharmaceutical shipment had shipping papers which did not list the isotope's activity. The shipment was spent molybdenum-99 generators being returned to the manufacturer.
37. An LSA shipment did not have a "Radioactive - LSA" label on the package.
38. A shipment of two radioactive material industrial devices did not have the shipping labels indicated on the shipping papers.
39. An LSA radioactive material device shipment did not have a Yellow II label on the shipping container. The shipping papers did not contain the following information: (a) proper shipping name, (b) hazard class, (c) description of the physical form of the radioactive material, and (d) Transport Index. The carrier also did not have shipping papers for Class C explosives.
40. An LSA NOS shipment did not have proper shipping papers accompanying the shipment, listing the proper shipping name and name of the radio-nuclide.

The following table shows the typical violations found during the four years this surveillance study has been performed.

VIOLATION TYPES

CONTRACT YEAR	TOTAL STOPS	PACKAGES NOT BLOCKED AND BRACED	IMPROPER SHIPPING PAPERS	INACCESSIBLE SHIPPING PAPERS	NO SHIPPING PAPERS	IMPROPER PACKAGE PLACEMENT	TIPS	IMPROPERLY PREPARED OR MISSING SHIPPING LABELS	IMPROPER PLACARDING	CARRIERS WITH MULTIPLE VIOLATIONS	TOTAL STOPS WITH VIOLATIONS	PERCENT STOPS WITH VIOLATIONS
77-78	51		15			2			2	2	16	31%
78-79	51		5		2			8	6	4	20	39%
79-80	84		13	2	9	1		10	9	13	26	31%
80-81	117	6	13	4	4	3	6	10	10	15	40	34%
TOTAL	303	6	46	6	15	6	6	28	27	34	102	34%

You will note from the above table that as the number of stops increased, the types and number of multiple violations increased.

PACKAGE INSPECTION

Radiation surveys of radioactive material packages were performed on a limited basis since such optional data were normally too time consuming given the constraints (e.g., work priorities) placed on the troopers. The following information was obtained from the inspection forms completed by the troopers. In all instances, the package being inspected was removed from the vehicle to a dry shielded area (previously determined radiation levels at background) where the packages of radiation readings are conducted.

<u>Package Type</u>	<u>Surface mR/hr</u>	<u>3' mR/hr</u>	<u>TI Label</u>	<u>Isotope</u>	<u>Quantity</u>	<u>Shipping Label</u>
A	2.5	0.3	0.5	Ir-192	30.0Ci	II
A	30.0	0.5	0.9	Ir-192	95.0Ci	II
A	10.0	0.5	0.8	Ra-226	4.5mCi	II
A	10.0	0.5	0.5	Ra-226	4.5mCi	II
A	10.0	0.5	1.0	Ra-226	4.5mCi	II
A	4.0	0.3	0.4	I-123	80.0mCi	II
A	5.0	0.3	0.4	I-131	1.4mCi	II
A	15.0	none	0.3	I-131	1.4mCi	II
A	0.8	none	0.1	Mo-99	0.3mCi	II
A	1.5	0.1	1.1	Mixed	71.3mCi	II
				Overpack		
A	23.0	1.9	2.9	Mo-99	2.8Ci	III
A	19.0	1.0	2.2	Mo-99	2.2Ci	III
A	18.0	1.3	2.0	Mo-99	10.8Ci	III
A	20.0	2.0	2.0	Mo-99	16.6Ci	III
A	30.0	2.0	2.9	Mo-99	2.7Ci	III
A	48.0	2.5	2.8	Mo-99	2.5Ci	III
A	20.0	1.1	1.2	Mo-99	1.0Ci	III
A	20.0	1.2	1.2	Mo-99	1.0Ci	III
A	21.0	1.7	1.7	Mo-99	1.5Ci	III
A	50.0	2.0	2.0	I-131	106.0mCi	III
A	35.0	0.5	0.4	I-131	10.0mCi	III
A	15.0	0.5	0.9	P-32	34.0mCi	III
A	20.0	1.0	1.2	Ga-67	85.5mCi	III
A	19.0	1.3	3.0	Ga-67	258.0mCi	III
A	22.0	1.0	1.0	Tl-201	156.0mCi	III
A	12.0	1.5	2.0	Ir-192	78Ci	III
A	10.5	0.3	0.8	Mixed	106.8mCi	III
				Overpack		
A	1.7	0.5	0.7	Mixed	10.3mCi	III
				Overpack		
A	3.8	0.4	10.0	Mixed	0.3mCi	III
				Overpack		
B	24.0	2.6	3.4	Mo-99	350.0Ci	III
B	0.1	---	0.1	Waste	100mCi	I
Unknown	1.4	0.1	1.7	I-125	180.0mCi	III
Unknown	1.5	0.1	1.0	I-125	160.0mCi	III
Unknown	6.0	0.5	0.5	Hg-203	8.0mCi	III

Surface contamination did not exist as a result of the wipes performed during the package inspections. The package with the largest quantity of radioactive material in each vehicle was usually the only one inspected.

One of the operating policies of the troopers was that any time the vehicle driver does not have proper shipping papers, or there is an accident involving a carrier transporting radioactive materials, or excessive radiation levels are present, package inspection needs to be performed even though the vehicle's trailer may be sealed.

OBSERVATIONS

The work accomplished during the fourth surveillance contract year indicates that on the basis of the number of reports submitted by state troopers, the surface transit flow of radioactive materials in this state is low. However, the O'Hare Airport Surveillance Study indicates the transit flow of radioactive materials in this state is significantly higher than indicated by highway surveillance studies. The following equipment observations were noted during this contract year. One, spare probes, cables, etc. need to be available for replacement of defective components sent in for repairs. During the O'Hare Study, seven SPA-3 scintillation detectors and one cable used to connect the SPA-3 probe to the alarming rate meter RM-19, were noted to be defective and were sent to Eberline Instrument Company for repair. Two, Eberline SPA-3 scintillation probes should be relocated in the troopers' vehicles from the vehicle dashboard to the backdoor window removing the obstruction of view caused by the placement up front. Three, the protective cover (e.g., shock and temperature protective black sponge rubber) for the SPA-3 probe should be changed to a light colored material eliminating some of the heat absorption by the probe. Four, the alarming rate meters, RM-19s, should be modified as follows: (a) eliminate the dependence of meter operation on battery power (during 4 years, 10 batteries have been replaced), (b) alarm reset and alarm set should be one control allowing an individual to make adjustments with one hand while driving a vehicle, (c) response time for the meter should be set at 2 second response, (d) pulse height analysis (PHA) ability should be eliminated as a setting on the rate meter utilizing only gross (CPM) when used with the scintillation probe, and (e) a heavy duty meter should replace the existing meter eliminating breakage due to weather and direction of placement (i.e., on end facing the driver, or flat on the seat). During 4 years, 12 meters have been replaced.

RECOMMENDATIONS

The following recommendations are being made to improve the efficiency and effectiveness of the transportation study for whenever it is reactivated, since this is the last year for the Illinois contract.

1. A federal agency should offer courses to shippers, carriers, and their drivers explaining DOT regulations concerning radioactive material shipments. The troopers stated that the drivers of the vehicles were not knowledgeable of DOT regulations nor were they versed in the handling of radioactive materials. (For example, two large manufacturers of radiopharmaceuticals shipped packages with a total TI in excess of 50, claiming the carriers' vehicles were exclusive use, exempting them from a 50 TI requirement.) The course should be mandatory and at least two to three days in length, fully covering in detail all regulations governing radioactive material. This will not remove management's

responsibility of training and supervising their people, but will allow a driver to be cognizant in deciding whether to accept a shipment from a shipper if papers are not properly prepared, Transport Index exceeds 50, radiation levels in cab exceed 2 mR/hr, etc.

2. A federal agency should develop a specific course on enforcement and interpretation of radioactive material regulations. Presently the only course attended by the enforcement personnel is a two week course conducted in Oklahoma on hazardous materials enforcement which includes a one day brief session on radioactive materials.
3. The DOT regulations should be revised taking into consideration the hazardous nature, from a health physics aspect, of low-level shipments of radioactive material. One revision that should be considered is the establishment of a requirement limiting radiation levels in the cab areas of all vehicles to 2 mR/hr. The drivers of vehicles carrying radioactive material shipments are not considered radiation workers and so are not regulated, even though, based on our observation, a significant number of these individuals receive in excess of 500 millirems in a year.
4. Surveillance of medical radioactive material shipments should be intensified since the radiation levels in the cab area of the vehicles have been exceeding 2.0 mR/hr for the non-radiation worker (driver). Also, 80% of the Notices of Apparent Violation issued at the O'Hare surveillance study were issued to carriers of radiopharmaceuticals.
5. Strip chart recorders should be utilized that will connect to the Eberline Model RM-19's with scintillation probes and can be placed near the O'Hare International Airport area and I-55 bridge near East St. Louis as well as other major highways entering the state. This will determine the exact number of radioactive material shipments traversing the area on a 24-hour basis.

In summary, the last four years provided baseline data regarding the surface transportation of radioactive shipments within the state. There were several accomplishments which resulted from the study, such as carriers providing better blocking and bracing of packages, the total TI of package shipments being below 50 TI limit as indicated on the 12 inspection reports received near the end of this contract period, and the adoption and enforcement of the USDOT regulations by the Illinois DOT. The study did verify that most vehicles surveyed had radiation levels below the DOT limits and that the most frequent violations found were improper shipping papers, improperly prepared or missing shipping labels on packages, and improper placarding.

APPENDIX A
SURVEILLANCE DATA

THE FOLLOWING COMPUTER SORT INDICATES THE SURVEILLANCE ACTIVITY OCCURRING IN EACH DISTRICT. MOST OF THE SURVEYS DURING SEPTEMBER WERE AROUND O'HARE AIRPORT AT CHICAGO, ILLINOIS, BECAUSE OF A SPECIAL SEVEN DAY STUDY. A MAJORITY OF THE STOPS IN THE DISTRICT WERE AT WEIGHT SCALES WHERE USUALLY THERE HAS BEEN A HAZARDOUS MATERIAL TROOPER PRESENT FOR ONE SHIFT DURING THE DAY.

RADIATION SURVEILLANCE STOPS
BY STATE POLICE DISTRICT
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DISTRICT	TROOPER	MONTH	LOCATION	SHIPPER	SHIPPER STATE	ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS	TOTAL TI	DOT NON COMPLY ITEMS *
STERLING	PERSON	SEP	OLD MANHEIM	MEDI PHYSIC	IL	MIXED	1,046.0	MCI	MED	9.2	
STERLING	PERSON	SEP	OLD MANHEIM	MALINCKRODT	MO	MIXED	592.0	MCI	MED	.0	
STERLING	PERSON	SEP	OLD MANHEIM	MALINCKRODT	MO	MIXED	3,062.1	MCI	MED	15.2	2.200
STERLING	PERSON	SEP	OLD MANHEIM	MEDI PHYSIC	IL	TL201	1,508.1	MCI	MED	1.2	2.504A
STERLING	PERSON	SEP	OLD MANHEIM	MALINCKRODT	MO	M099	5.5	CI	MED	6.3	
ELGIN	MASON	AUG	US41@IL173	WESTINGHOUSE	SC	U-235	9,840.0	MCI	LSA	9.0	
ELGIN	KARNETT	SEP	LAWRENCE	N.E.N.	IL	TL&GA	26.0	MCI	MED	.2	
ELGIN	HENEISE	SEP	KENNEDY	SQUIBB	NJ	MO&I31	12,489.0	MCI	MED	10.7	2.506A1
BLUE ISLAND	CAREY	SEP	OLD MANHEIM	SEAMAN NUC	WI	RA-BE	4.5	MCI	IND	1.0	
BLUE ISLAND	CAREY	SEP	LAWRENCE	UNION CARBID	NY	M099	10.8	CI	MED	2.0	2.506A1
BLUE ISLAND	CAREY	SEP	LAWRENCE	EBERHARDT	CA	RA-BE	4.5	MCI	IND	.5	
BLUE ISLAND	FITCH	SEP	LAWRENCE	N.E.N.	IL	MIXED	5.6	CI	MED	18.6	2.506A1
JOLIET	MYERS	JAN	I80 WB	CONAM	IL	IR-192	78.0	CI	IND	1.5	
JOLIET	MYERS	JAN	IL 23	MALNKR&SQUIB	MO	MIXED	27,210.0	MCI	MED	59.3	3.393J4
JOLIET	STEIBER	FEB	I80 WB	NUC. METALS	MA	U DEP	720.0	MCI	LSA	.0	2.504A
JOLIET	MYERS	FEB	I80 WB	WESTINGHOUSE	PA	U&PU	100.0	MCI	LSA	.1	
JOLIET	STEIBER	MAR	I80 WB	NEVIS LABS	NY	CO-60	.1	UCI	LSA	.0	3.392C8
JOLIET	MYERS	AUG	I80	ARGON NAT LB	IL	PU-239	13.4	CI	LSA	6.0	
JOLIET	MYERS	AUG	I80	EXXON	WA	U-235	6,920.0	MCI	LSA	28.8	
JOLIET	STEIBER	SEP	OLD MANHEIM	MALINCKRODT	MO	MIXED	19.0	CI	MED	22.1	3.393J4
JOLIET	STEIBER	SEP	OLD MANHEIM	AMERSHAM	EN	MIXED	.0	MCI	MED	30.1	2.202A1
JOLIET	STEIBER	SEP	OLD MANHEIM	MEDI PHYSICS	IL	MIXED	1,680.0	MCI	MED	10.2	
JOLIET	STEIBER	SEP	OLD MANHEIM	MEDI PHYSIC	IL	MIXED	14.1	MCI	MED	1.7	
JOLIET	STEIBER	SEP	OLD MANHEIM	MEDI PHYSIC	IL	MIXED	413.7	MCI	MED	2.4	
JOLIET	STEIBER	SEP	OLD MANHEIM	MEDI PHYSICS	IL	MIXED	140.2	MCI	MED	1.7	
JOLIET	STEIBER	SEP	OLD MANHEIM	MEDI PHYSIC	IL	MIXED	197.3	MCI	MED	1.8	
JOLIET	STEIBER	SEP	OLD MANHEIM	MEDI PHYSIC	CA	GA-67	507.0	MCI	MED	8.2	
JOLIET	MYERS	SEP	OLD MANHEIM	UNKNOWN		MIXED	5,186.5	MCI	MED	1.1	2.504A
JOLIET	MYERS	SEP	OLD MANHEIM	AMERSHAM	IL	MIXED	57.1	MCI	MED	2.6	
JOLIET	MYERS	SEP	OLD MANHEIM	AMERSHAM	IL	MIXED	14,349.0	UCI	MED	.3	
JOLIET	POMYKALA	SEP	OLD MANHEIM	ST MARYS	WI	M099	441.0	MCI	MED	.2	
JOLIET	POMYKALA	SEP	OLD MANHEIM	PITTSBURG TES	IL	IR-192	46.3	CI	IND	1.5	
JOLIET	MYERS	SEP	OLD MANHEIM	PHARMATOPE	IL	MO-99	527.0	UCI	MED-WAS	.3	
JOLIET	MYERS	SEP	US51@I80	G.E. MORRIS	IL	MIXED	157.8	MCI	WASTE	7.0	
JOLIET	MYERS	OCT	US51@IL71	MALINCKRODT	MO	MO&I31	2,606.0	MCI	MED	4.9	
JOLIET	MYERS	OCT	US51@I80	RMI CO.	OH	U DEP	56.0	MCI	LSA	.1	
JOLIET	MYERS	NOV	I80	SUP IND	IL	IR-192	30.0	CI	IND	.5	
JOLIET	MYERS	DEC	I80 WB	TELEDYNE	NJ	MIXED	821.0	MCI	WASTE	.0	
PONTIAC	BUSH	JUL	US24@SCALE	C EDISON MOR	IL	MIXED	1.0	CI	WASTE	.0	
PONTIAC	BUSH	AUG	US24 SCALE	C EDISON MOR	IL	MIXED	80,720.0	MCI	WASTE	.0	
PONTIAC	BUSH	SEP	KENNEDY	PEABODY	IL	IR192	90.0	CI	IND	.7	2.403F
PONTIAC	BUSH	SEP	HIGN&ARMSTR	AMERSHAM	IL	MIXED	129.3	MCI	MED	2.9	2.203
PONTIAC	BUSH	SEP	KENNEDY WB	PEABODY TEST	IL	IR-192	80.0	CI	IND	.9	
ROCK ISLAND	BEIN	JAN	I80 WB	TELEDYNE	NY	MIXED	457.9	MCI	WASTE	.0	
ROCK ISLAND	BEIN	FEB	I80	C EDISON COR	IL	MIXED	16,757.8	MCI	WASTE	2.0	
ROCK ISLAND	BEIN	MAR	I80 EB	EG&G IDAHO	ID	U235CO	49.6	CI	LSA	.3	
ROCK ISLAND	BEIN	MAR	I80 EB	EDISON COR I	LC	MIXED	22,716.8	MCI	LSA	.1	
ROCK ISLAND	BEIN	AUG	I74	IOWA ELEC	IA	MIXED	83.0	MCI	WASTE	.0	
ROCK ISLAND	BEIN	SEP	I80	ARGON NAT LB	IL	MFP	29,000.0	LBS	LSA	1.5	

RADIATION SURVEILLANCE STOPS
 BY STATE POLICE DISTRICT
 PREPARED FOR TRANSPORTATION CONTRACT WITH HRC & DOT

DISTRICT	TROOPER	MONTH	LOCATION	SHIPPER	SHIPPER STATE	ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS	TOTAL TI	DOT NON COMPLY ITEMS *
ROCK ISLAND	BEIN	SEP	LAWRENCE	SQUIBB	NJ	I-131	1.4	MCI	MED	.4	
ROCK ISLAND	BEIN	OCT	I80	N.E.N.	MA	MIXED	8,192.7	MCI	WASTE	15.0	
ROCK ISLAND	BEIN	NOV	IL50MOLINE	REESE&ASSOC	IL	CS-AM	50.0	MCI	IND	.1	
ROCK ISLAND	BEIN	DEC	I80	C EDISON COR	IL	MIXED	10,449.9	MCI	WASTE	6.0	
ROCK ISLAND	BEIN	DEC	I80 WB	N.E. NUC	CT	MIXED	19,320.0	UCI	WASTE	.0	
ROCK ISLAND	BEIN	DEC	I80 WB	RADIAC RES	NY	TC99M	36,447.0	LBS	WASTE	4.5	
PEORIA	ASHBY	JAN	I474 WB	QUAD CITY T	IA	IR-192	58.0	CI	IND	1.2	7.817A
PEORIA	ASHBY	AUG	I74	C EDISON COR	IL	MIXED	19,832.9	MCI	WASTE	32.0	
PEORIA	ASHBY	AUG	I74	OMAHA POWER	NB		4,146.0	MCI	WASTE	.0	
PEORIA	ASHBY	SEP	I74	C EDISON COR	IL	MIXED	8,750.0	MCI	WASTE	.0	
PEORIA	ASHBY	SEP	I74	C EDISON COR	IL	MIXED	8,750.0	MCI	WASTE	.0	
PEORIA	ASHBY	SEP	KENNEDY	DIAG MEDI P	NJ	MIXED	7,667.0	MCI	MED	57.2	7.817E2
PEORIA	ASHBY	SEP	KENNEDY	CORNING MED	MS	UNK	.0	MCI	MED	.0	2.502A
PEORIA	ASHBY	SEP	IL90	CENT. GEO	OK	CS-137	125.0	MCI	IND	.2	
PEORIA	BORNEMAN	OCT	IL116@POST1	WIS IND	WI	IR-192	20.0	CI	IND	.0	2.101
PEORIA	ASHBY	DEC	I74 WB	MONSANTO	OH	PU-238	1,820.9	MCI	LSA	.0	
SPRINGFIELD	MUELLER	JAN	I55 SB	KAY RAY	IL	CS-137	.0	CI	IND	3.0	2.504A
SPRINGFIELD	MUELLER	FEB	I55	C EDISON DRE	IL	MIXED	57,800.0	MCI	WASTE	2.6	
SPRINGFIELD	MUELLER	MAR	I55	VARIOUS HOSP	MO	MO-99	509.9	MCI	WAS-MED	4.4	2.203D3
SPRINGFIELD	MUELLER	JUN	I55	AMERSHAM	IL	CF-252	27.0	MCI	IND	5.0	
SPRINGFIELD	MUELLER	SEP	HIGNS&MT PR	AMERSHAM	IL	MIXED	505.0	MCI	MED	4.8	
SPRINGFIELD	MUELLER	SEP	HIGN&ARMSTR	AMERSHAM	IL	MIXED	3.5	CI	MED	6.5	2.203
SPRINGFIELD	MUELLER	OCT	N.GRAND&MAC	WIS IND	WI	IR-192	25.0	CI	IND	1.1	2.403CI
SPRINGFIELD	MUELLER	DEC	I55 NB	MALINCKRODT	MO	MIXED	112.7	CI	MED	189.8	3.393J3
URBANA	DEBAUN	MAR	US36&IL1	K RAY&MAG.IN	IL	IR&CS	500.0	MCI	IND	.3	2.203D4
URBANA	DEBAUN	MAR	IL121	D.ATLAS	IL	AM&BE	4.5	CI	IND	3.0	
URBANA	DEBAUN	MAR	IL121	BASIN SURVEY	IL	AM&BE	3.0	CI	IND	.7	2.403C
URBANA	DEBAUN	SEP	OLD MANHEIM	MEDI PHYSIC	IL	NA&I23	30.2	MCI	MED	1.2	
URBANA	DEBAUN	SEP	OLD MANHEIM	EBERLINE	NM	MIXED	.4	MCI	LSA	.4	2.202A1
MARYVILLE	STYGAR	MAR	IL3	GE NUC.CENTR	CA	XE-133	1.4	CI	MED	.5	
MARYVILLE	STYGAR	SEP	LAWRENCE	MALINCKRODT	MO	I31&TL	250.0	MCI	MED	1.0	
MARYVILLE	STYGAR	SEP	LAWRENCE	MALINCKRODT	MO	I,MO&P	106.6	CI	MED	132.3	2.401
EFFINGHAM	SCHAEFER	MAR	I70 WB	BRUSH WILMAN	OH	SB124	250.0	MCI	IND	2.0	
EFFINGHAM	SCHAEFER	APR	I70 WB	WESTINGHOUSE	PA	MFP	6,224.0	UCI	LSA	10.0	
EFFINGHAM	SCHAEFER	JUN	RT33@MONTRO	C 3DISON DRE	IL	MIXED	4,604.0	MCI	WASTE	20.0	
EFFINGHAM	SCHAEFER	JUN	I70	KERR-MCGEE	OK	UF6	3.0	CI	LSA	3.0	
EFFINGHAM	SCHAEFER	JUL	I57	DENISON MINE	ON	U NAT	5.8	CI	LSA	5.0	
EFFINGHAM	SCHAEFER	JUL	I70	TEXAS NUC	TX	CS-137	40.0	MCI	IND	1.0	
EFFINGHAM	SCHAEFER	AUG	I70	NL IND	NY	U-238	24.2	CI	WASTE	20.0	
EFFINGHAM	SCHAEFER	SEP	KENNEDY	MEDI PHYSIC	IL	MIXED	25.8	MCI	MED	1.3	
EFFINGHAM	SCHAEFER	SEP	KENNEDY	AMERSHAM	EN	MIXED	103.2	CI	MED	25.8	
EFFINGHAM	SCHAEFER	SEP	KENNEDY	AMERSHAM	IL	MIXED	1,116.0	MCI	MED	4.9	
EFFINGHAM	SCHAEFER	NOV	EFINGHAM	SQUIBB	NJ	MO-99	725.0	MCI	MED	2.2	7.842
EFFINGHAM	SCHAEFER	NOV	IL33@EFINGH	DRESSER AT	IL	CS&AM	20.0	CI	IND	10.0	
EFFINGHAM	SCHAEFER	DEC	I70 EB	MALINCKRODT	MO	IL31MO	106.2	CI	MED	106.2	
DUQUOIN	GOFORTH	JUN	I57	RIO ALGOM	UT	U NAT	21,667.0	LBS	LSA	.0	2.203D2
DUQUOIN	GOFORTH	JUN	I57	EXXON	WY	U NAT	2.5	CI	LSA	.0	
DUQUOIN	GOFORTH	JUN	I57	DENISON MINE	ON	U NAT	5.8	CI	LSA	5.0	
DUQUOIN	GOFORTH	JUL	I57	SIERRA ARMY	CA	U DEP	1,749.3	MCI	IND	.4	

APPENDIX A

RADIATION SURVEILLANCE STOPS
 BY STATE POLICE DISTRICT
 PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DISTRICT	TROOPER	MONTH	LOCATION	SHIPPER	SHIPPER STATE	ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS	TOTAL TI	DOT NON COMPLY ITEMS *
DUQUOIN	GOFORTH	JUL	I57 SCALES	DENISON MINE	OH	U NAT	5.8	CI	LSA	5.0	
DUQUOIN	GOFORTH	SEP	I57	KERR MCGEE	NM	U NAT	41,605.0	LBS	LSA	.0	2.203D1
DUQUOIN	GOFORTH	SEP	I57	HOMESTAKE	CA	U NAT	11,180.0	MCI	LSA	5.8	7.817E2
DUQUOIN	GOFORTH	SEP	LAWRENCE	NEN	NJ	MIXED	3,345.0	MCI	MED	4.8	
DUQUOIN	GOFORTH	NOV	I57	UNITED NUC	HM	U NAT	10,140.0	MCI	LSA	.0	
MACOMB	ANDREWS	SEP	LAWRENCE	UNION CARB	NY	I-131	1,149.0	MCI	MED	2.8	
MACOMB	ANDREWS	SEP	LAWRENCE	AMERSHAM	EN	MIXED	860.0	MCI	MED	3.2	2.201A2
OAKBROOK	GOMORA	APR	I-5 WB PLAZ	PROD.TOOL CO	IL	UNK	200.0	UCI	LSA	1.3	2.200A1
OAKBROOK	GOMORA	SEP	KENNEDY	PEABODY TEST	IL	IR-192	95.0	CI	IND	1.3	7.817A
OAKBROOK	GOMORA	SEP	KENNEDY	AMERSHAM	IL	NA-22	5.4	MCI	MED	5.3	
OAKBROOK	GOMORA	SEP	I5 PLAZA51	SUP IND	IL	IR-192	33.0	CI	IND	1.8	7.817A
ROCKFORD	JOHNSON	SEP	LAWRENCE	WMU	MI	RA-BE	4.5	MCI	IND	.5	7.842D
ROCKFORD	JOHNSON	SEP	LAWRENCE	ROLO-U OF MO	MO	MO-99	350.0	CI	MED	2.4	2.506A1
ROCKFORD	JOHNSON	SEP	LAWRENCE	VARIOUS		MIXED	20.2	CI	MED	2.6	
ROCKFORD	JOHNSON	SEP	LAWRENCE	UNION CARB	NY	MO-99	16.6	CI	MED	2.0	
ROCKFORD	JOHNSON	SEP	HIGH&MT PRS	MALINCKRODT	MO	MIXED	114.8	CI	MED	188.1	3.393J4
ROCKFORD	JOHNSON	NOV	US20&I90	AMF CARM	IL	IR-192	3.2	CI	IND	2.0	
ROCKFORD	JOHNSON	NOV	IL26&AVON	N.E.N.	MA	MIXED	15.0	CI	MED	50.0	2.504
ROCKFORD	JOHNSON	DEC	US20&PEC RD	N.E.N.	MA	MO99	55.4	CI	MED	45.1	3.393J4

APPENDIX A

*49 CFR 17 Section Violation
 (i.e. 49 CFR 172.203(d)(1) is 2.2 0 3 D 1 _

RADIOACTIVE MATERIAL MOVEMENT

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	<u>Total No. Stops</u>	<u>Total Activity (Ci) No. Stops</u>	<u>Activity</u>	<u>Avg. Activity Per Shipment (Ci)</u>	<u>Total Weight No. Stops</u>	<u>Weight (lbs)</u>	<u>Avg. Weight Per Shipment (lbs)</u>
Medical*	49	49	1149.52	23.46			
Limited**	1	1	.000527	.00053			
Waste (LSA)	19	18	247.251	13.736	1	36,447	36,447
Fuel Cycle(LSA)	23	20	126.706	6.335	3	92,272	30,757
Industrial*	25	25	588.755	23.55			

*One medical shipment and one industrial shipment did not have quantities listed.

**Limited packages were not inspected due to other priorities.

APPENDIX A

RADIATION SURVEILLANCE STOPS
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

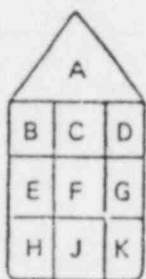
DATE	ROUTE	DISTRICT	CARRIER	ISOTOPE	QUANTITY	NO. QUAN PACK UNIT	TOTAL INSPEC TI	DESTIN ATION STATE	VEHICLE TYPE	PACKAGE* PLACE	SHIP FAFR	PROP PLAC	DOT NCR COMPLY ITEMS
8/09/80	RT332MONTRO	EFFINGHAM	HITMAN NUC	MIXED	4,604.0	MCI	20.0	SC	SEMI	MID CENT	YES	YES	
8/13/80	155	SPRINGFIELD	CONSOL FRT.	CF-252	27.0	MCI	5.0	TX	DBL.BOTT	MID REAR	YES	YES	
8/19/80	157	DUQUOIN	YELLOW FRT.	U NAT	21,667.0	LBS	.0	IL	SEMI	ALL	YES	YES	(1)
8/20/80	157	DUQUOIN	TRI STATE	U NAT	2.5	CI	.0	IL	SEMI	ALL	YES	YES	
8/20/80	157	DUQUOIN	ELIOT LAKE FRT	U NAT	5.8	CI	5.0	IL	SEMI	ALL	YES	YES	
8/25/80	170	EFFINGHAM	TRI STATE	UF6	3.0	CI	3.0	OH	SEMI	FR&REARMID	YES	YES	
7/17/80	157	DUQUOIN	BAGGETT TRAN	U DEP	1,749.3	MCI	.4	NC	SEMI	ALL	YES	YES	
7/21/80	US2425SCALE	PONTIAC	HITMAN NUC	MIXED	1.0	CI	.0	SC	SEMI	MID CENT	YES	YES	(2)
7/22/80	157 SCALES	DUQUOIN	ELIOT LAKE FRT	U NAT	5.8	CI	5.0	IL	SEMI	ALL	YES	YES	
7/25/80	157	EFFINGHAM	ELIOT LAKE FRT	U NAT	5.8	CI	3	IL	SEMI	ALL	YES	YES	
7/28/80	170	EFFINGHAM	LEEWAY FRT.	CS-137	40.0	MCI	1.0	PA	DBL.BOTT	MID REAR	YES	YES	
8/12/80	174	ROCK ISLAND	HITMAN NUC	MIXED	83.0	MCI	1	SC	SEMI	MIDDLE	YES	YES	
8/13/80	US41211173	ELGIN	C&H TRANS.	U-235	9,840.0	MCI	9.0	IL	SEMI	MID CENT	YES	YES	
8/13/80	174	PEORIA	HITMAN NUC	MIXED	19,832.9	MCI	32.0	SC	SEMI	MID CENT	YES	YES	
8/22/80	170	EFFINGHAM	NL INDUSTRIES	U-238	24.2	CI	20.0	WA	SEMI	ALL	YES	YES	
8/22/80	130	JOLIET	TRI STATE	PU-239	13.4	CI	6.0	ID	SEMI	ALL	YES	YES	
8/25/80	130	JOLIET	TRI STATE	U-235	6,920.0	MCI	28.8	NJ	SEMI	ALL	YES	YES	
8/25/80	US24 SCALE	FONTIAC	MCCORMACK TRAN	MIXED	80,720.0	MCI	1	SC	SEMI	MID CENT	YES	YES	
8/27/80	174	PEORIA	CHEM NUC	MIXED	4,146.0	MCI	.0	SC	SEMI	ALL	YES	YES	
9/03/80	157	DUQUOIN	ARK. BEST FRT	U NAT	41,605.0	LBS	.0	IL	SEMI	ALL	YES	YES	(3)
9/03/80	157	DUQUOIN	ARK. BEST FRT	U NAT	11,180.0	MCI	5.8	IL	SEMI	ALL	YES	YES	(4)
9/03/80	174	PEORIA	CHEM NUC	MIXED	8,750.0	MCI	.0	SC	SEMI	FR&REAR	CEN	YES	YES
9/03/80	174	PEORIA	CHEM NUC	MIXED	8,750.0	MCI	.0	SC	SEMI	FR&REARMID	YES	YES	
9/10/80	160	ROCK ISLAND	TRI STATE	MFP	29,000.0	LBS	1.5	ID	SEMI	ALL	YES	YES	
9/13/80	OLD MANHEIM	JOLIET	CASPERSON	MIXED	19.0	CI	22.1	IL	PICK-UP	MID&LEFT	YES	YES	(5)
9/13/80	OLD MANHEIM	JOLIET	PRIVATE COUR	MIXED	.0	MCI	30.1	IL	ST. TRUCK	ALL	YES	YES	(6)
9/14/80	OLD MANHEIM	STERLING	PRIVATE COUR	MIXED	1,046.0	MCI	2		VAN	MID & REAR	YES	YES	
9/14/80	OLD MANHEIM	JOLIET	PRIVATE COUR	MIXED	1,680.0	MCI	3		VAN	REAR	YES	YES	
9/14/80	KENNEDY	PEORIA	PRIVATE COUR	MIXED	7,667.0	MCI	57.2	IL	VAN	L&MID REAR	YES	YES	(7)
9/15/80	KENNEDY	OAKBROOK	PEABODY TEST	IR-192	95.0	CI	1.3	IL	PICK-UP	MID RIGHT	YES	NO	(8)
9/15/80	OLD MANHEIM	STERLING	CASPERSON	MIXED	592.0	MCI	.0	IL	VAN	REAR LEFT	YES	YES	
9/15/80	LAWRENCE	ELGIN	PUROLATOR	TL&GA	26.0	MCI	5	IA	VAN	REAR LEFT	YES	N/A	
9/15/80	OLD MANHEIM	STERLING	CASPERSON	MIXED	3,062.1	MCI	2	MO	VAN	REAR	YES	YES	(9)
9/15/80	HIGHSMITH PR	SPRINGFIELD	PRIVATE COUR	MIXED	505.0	MCI	1		ST. TRUCK	REAR	YES	YES	
9/15/80	OLD MANHEIM	STERLING	CASPERSON	TL201	1,508.1	MCI	1.2	MO	VAN	REAR	YES	NO	(10)
9/15/80	OLD MANHEIM	JOLIET	PRIVATE COUR	MIXED	14.1	MCI	3		VAN	REAR	YES	N/A	
9/15/80	KENNEDY	ELGIN	PARKSIDE MOTOR	MO&I31	12,489.0	MCI	2	IL	AUTO	REAR	YES	NO	(11)
9/16/80	OLD MANHEIM	BLUE ISLAND	AAA CARTAGE	RA-BE	4.5	MCI	1	WI	SEMI	MID RIGHT	YES	N/A	
9/16/80	KENNEDY	OAKBROOK	PRIVATE COUR	NA-22	5.4	MCI	5.3		VAN	REAR CENT	YES	YES	
9/16/80	HIGHARMSTR	SPRINGFIELD	PRIVATE COUR	MIXED	3.5	CI	1		ST. TRUCK	REAR	YES	YES	(12)
9/16/80	OLD MANHEIM	JOLIET	PRIVATE COUR	MIXED	413.7	MCI	2.4		VAN	REAR	YES	N/A	
9/16/80	OLD MANHEIM	JOLIET	PRIVATE COUR	MIXED	140.2	MCI	1.7		VAN	REAR MID&R	YES	N/A	
9/16/80	OLD MANHEIM	JOLIET	PRIVATE COUR	MIXED	197.3	MCI	1		VAN	REAR	YES	N/A	
9/16/80	LAWRENCE	DUQUOIN	PRIVATE COUR	MIXED	3,345.0	MCI	4.8	IL	ST. TRUCK	L MID&REAR	YES	YES	
9/16/80	KENNEDY	PEORIA	PARKSIDE MOTOR	UNK	.0	MCI	.0	IN	PICK-UP	FRONT R	YES	NO	(13)
9/16/80	OLD MANHEIM	JOLIET	PRIVATE COUR	GA-67	507.0	MCI	3	IL	VAN	REAR	YES	YES	
9/16/80	OLD MANHEIM	JOLIET	FEDERAL EXP	MIXED	5,186.5	MCI	1.1		ST. TRUCK	R&MID MID	YES	NO	(14)
9/16/80	OLD MANHEIM	STERLING	CASPERSON	MO99	5.5	CI	6.3		VAN	MIDDLE	YES	YES	
9/17/80	OLD MANHEIM	URBANA	PRIVATE COUR	NA&I23	30.2	MCI	1.2		VAN	REAR	YES	YES	
9/17/80	LAWRENCE	BLUE ISLAND	PHARMOTOPE	MO99	10.8	CI	1	IL	AUTO	REAR CENT	YES	NO	(15)
9/17/80	LAWRENCE	ROCK ISLAND	PARKSIDE MOTOR	I-131	1.4	MCI	1	IL	AUTO	REAR CENT	YES	YES	

RADIATION SURVEILLANCE STOPS
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

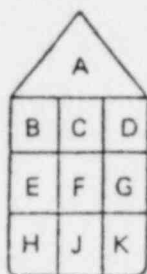
DATE	ROUTE	DISTRICT	CARRIER	ISOTOPE	QUANTITY	QUAN. UNIT	NO. PACK	TOTAL TI	DESTIN ACTION STATE	VEHICLE TYPE	PACKAGE* PLACE	SHIP PAPER	PROT PLAC	DOT NON COMPLY ITEMS
9/17/80	OLD MANHEIM	JOLIET	AIRBORN FRT	MIXED	57.1	MCI		2.6			MIDDLE	YES	YES	
9/17/80	HIGHWAY 51R	PONTIAC	PRIVATE COUR	MIXED	129.3	MCI	1	2.9	HJ	ST. TRUCK	REAR RIGHT	YES	YES	(16)
9/17/80	KENNEDY	EFFINGHAM	PRIVATE COUR	MIXED	25.8	MCI		1.3	FA	VAN	REAR	YES	YES	
9/17/80	KENNEDY	PONTIAC	PEABODY TEST	IR-192	90.0	CI	1	.7	IL	PICK-UP	MID RIGHT	YES	YES	(17)
9/17/80	LAWRENCE	MARYVILLE	CASPERSON	I311TL	250.0	MCI	5	1.0		VAN	MID REAR L	YES	YES	
9/18/80	LAWRENCE	BLUE ISLAND	FEDERAL EXP	RA-BE	4.5	MCI	1	.5	WI	ST. TRUCK	REAR CENT	YES	N/A	
9/18/80	LAWRENCE	ROCKFORD	KHS AIR FRT	RA-BE	4.5	MCI	1	.5	WI	SEMI	REAR CENT	YES	N/A	(18)
9/18/80	OLD MANHEIM	JOLIET	AIRBORN FRT	MIXED	14,349.0	UCI		.3		ST. TRUCK	REAR RIGHT	YES	N/A	
9/18/80	OLD MANHEIM	URBANA	BIT INC.	MIXED	.4	MCI	1	.4	IL	ST. TRUCK	MID RIGHT	YES	NO	(19)
9/18/80	KENNEDY	EFFINGHAM	PRIVATE COUR	MIXED	103.2	CI		25.8	IL	ST. TRUCK	REAR	YES	YES	
9/18/80	OLD MANHEIM	JOLIET	CASPERSON	MO99	441.0	MCI	1	.2	MO	VAN	REAR LEFT	YES	N/A	
9/18/80	LAWRENCE	MACOMB	PRIVATE COUR	I-131	1,149.0	MCI		2.8	IL	VAN	REAR CENT	YES	YES	
9/18/80	KENNEDY	PONTIAC	PEABODY TEST	IR-192	80.0	CI		.9	IL	PICK-UP	MID RIGHT	YES	YES	
9/19/80	LAWRENCE	ROCKFORD	FEDERAL EXP	MIXED	20.2	CI		2.6		ST. TRUCK	MID LEFT	YES	YES	
9/19/80	LAWRENCE	ROCKFORD	PHARMOTGPE	MO-99	15.6	CI	1	2.0	IL	AUTO	REAR CENT	YES	YES	
9/19/80	OLD MANHEIM	JOLIET	UNITED AIR	MO-99	527.0	UCI	2	.3	YO	ST. TRUCK	MID LEFT	YES	YES	
9/19/80	KENNEDY	EFFINGHAM	PRIVATE COUR	MIXED	1,116.0	MCI	5	4.9	OH	VAN	REAR	YES	YES	
9/19/80	LAWRENCE	MACOMB	PRIVATE COUR	MIXED	660.0	MCI	7	3.2	IL	VAN	REAR	YES	YES	(20)
9/19/80	LAWRENCE	ROCKFORD	AIR COUR	MO-99	350.0	CI		2.4	IL	SEMI	FRONT R	YES	NO	(21)
9/19/80	OLD MANHEIM	JOLIET	FEDERAL EXP	IR-192	46.3	CI	2	1.5	LA	VAN	MID MID	YES	YES	
9/19/80	LAWRENCE	MARYVILLE	CASPERSON	I, MO4P	106.6	CI	1	132.3		ST. TRUCK	ALL	YES	YES	(22)
9/20/80	LAWRENCE	BLUE ISLAND	CONTRACT COUR	MIXED	5.6	CI	1	18.6	1	AUTO	MIDDLE	YES	NO	(23)
9/20/80	PRIS	ROCKFORD	CASPERSON	MIXED	114.8	CI	2	183.1		ST. TRUCK	ALL	YES	YES	(24)
9/24/80	USS1180	JOLIET	TRI STATE	MIXED	157.8	MCI		7.0	NV	SEMI	ALL	YES	YES	
9/26/80	IL90	PEORIA	CENTURY GEO.	CS-137	125.0	MCI		.2		ST. TRUCK	REAR RIGHT	YES	YES	
9/29/80	IS PLAZA 51	OAKBROOK	SUP. IND. X-RAY	IR-192	33.0	CI		1.8	IL	PICK-UP	REAR LEFT	NO	YES	(25)
10/02/80	N. GRANDMAC	SPRINGFIELD	WIS. IND. TEST	IR-192	25.0	CI		1.1		PICK-UP	REAR RIGHT	YES	YES	(26)
10/17/80	180	ROCK ISLAND	TRI STATE	MIXED	8,192.7	MCI		15.0	NV	SEMI	ALL	YES	YES	
10/19/80	USS10171	JOLIET	CASPERSON	MO1131	2,406.0	MCI	3	4.9	IL	VAN	REAR MID4R	YES	YES	
10/20/80	IL1160POST1	PEORIA	WIS. IND. TEST	IR-192	20.0	CI		.0		PICK-UP	REAR RIGHT	NO	YES	(27)
10/31/80	USS10180	JOLIET	RYDER RANGER	U DEP	56.0	MCI		.1	CA	SEMI	ALL	YES	YES	
11/03/80	180	JOLIET	SUP. IND. X-RAY	IR-192	30.0	CI	1	.5		PICK-UP	REAR CENT	YES	YES	
11/06/80	IL30NDLINE	ROCK ISLAND	RESECLASSO	CS-AM	50.0	MCI		1.1	IL	PICK-UP	CAB AREA	YES	N/A	
11/10/80	EFFINGHAM	EFFINGHAM	ASSOC. COUR	MO-99	725.0	MCI		2.2	IL	VAN	REAR LEFT	YES	YES	(28)
11/12/80	IL330EFFINGH	EFFINGHAM	DRESSER ATLAS	CS4AM	20.0	CI		10.0	IL	ST. TRUCK	REAR CENT	YES	YES	
11/13/80	157	DUQUOIN	INMAN HUB FRT	U HAT	10,140.0	MCI		.0	IL	SEMI	ALL	YES	YES	
11/20/80	US204190	ROCKFORD	AMF TUBSCOPE	IR-192	3.2	CI		2.0	IL	ST. TRUCK	REAR CENT	YES	YES	
11/30/80	IL262AVONH	ROCKFORD	CONTRACT COUR	MIXED	15.0	CI		50.0	IL	PICK-UP	ALL	YES	NO	(29)
12/04/80	130	ROCK ISLAND	HACKE TRK.	MIXED	10,449.9	MCI		6.0	SC	SEMI	MID CENT	YES	YES	
12/07/80	100 WB	JOLIET	TRI STATE	MIXED	821.0	MCI		.0	WA	SEMI	ALL	YES	YES	
12/10/80	174 WB	PEORIA	P. I. E.	PU-238	1,820.9	MCI		.0	NV	SEMI	ALL	YES	YES	
12/20/80	155 NB	SPRINGFIELD	CASPERSON	MIXED	112.7	CI		189.8		ST. TRUCK	ALL	YES	YES	(30)
12/25/80	170 EB	EFFINGHAM	CASPERSON	I131MO	106.2	CI		106.2	NY	SEMI	ALL	YES	YES	
12/28/80	US204PEC RD	ROCKFORD	CONTRACT COUR	MO99	55.4	CI		45.1		PICK-UP	MID & REAR	YES	YES	(31)
12/31/80	180 WB	ROCK ISLAND	TRI STATE	MIXED	19,320.0	UCI		.0	WA	SEMI	ALL	YES	YES	
12/31/80	150 WB	ROCK ISLAND	TRI STATE	TC99M	36,447.0	LBS		4.5	WA	SEMI	ALL	YES	YES	
1/05/81	180 WB	JOLIET	CONAM	IR-192	78.0	CI	1	1.5		PICK-UP	MID RIGHT	YES	YES	
1/08/81	180 WB	ROCK ISLAND	TRI STATE	MIXED	457.9	MCI		.0	WA	SEMI	ALL	YES	YES	
1/23/81	155 SB	SPRINGFIELD	ORSCHELN BR TR	CS-137	.0	CI		3.0	NO	SEMI	MID CENT	YES	YES	
1/29/81	1474 WB	PEORIA	QUAD CITY TEST	IR-192	58.0	CI		1.2		PICK-UP	REAR LEFT	NO	YES	(32)
1/31/81	IL 23	JOLIET	CASPERSON	MIXED	27,210.0	MCI		59.3		VAN	ALL	YES	YES	(33)
2/05/81	180 WB	JOLIET	RYDER RANGER	U DEP	720.0	MCI		.0	WA	SEMI	ALL	YES	YES	(34)
2/09/81	180 WB	JOLIET	TRI STATE	U4PU	100.0	MCI	1	.1	WA	SEMI	CENT-REAR	YES	YES	(35)
2/25/81	180	ROCK ISLAND	HACKE TRK.	MIXED	16,757.8	MCI		2.0	SC	SEMI	MID CENT	YES	YES	
2/26/81	155	SPRINGFIELD	HACKE TRK.	MIXED	57,800.0	MCI		2.6	SC	SEMI	MID CENT	YES	YES	
3/05/81	100 EB	ROCK ISLAND	TRI STATE	U235CO	49.6	CI		.3	PA	SEMI	MID CENT	YES	YES	
3/06/81	155	SPRINGFIELD	CASPERSON	MO-99	509.9	MCI		4.4	MO	ST. TRUCK	L&R REAR	YES	YES	(36)
3/12/81	180 WB	JOLIET	CROWN TRK	CO-60	.1	UCI	1	.0	IL	SEMI	ALL	YES	YES	(37)
3/12/81	US364111	URBANA	RYDER TRK	IR&CS	500.0	MCI		.3	LA	SEMI	RIGHT REAR	YES	YES	(38)
3/17/81	IL3	MARYVILLE	FEDERAL EXP	XE-133	1.4	CI		.5	NO	VAN	REAR RIGHT	YES	N/A	
3/19/81	IL121	URBANA	DRESER ATLAS	AM&DE	4.5	CI		3.0	IL	ST. TRUCK	REAR CENT	YES	YES	
3/19/81	IL121	URBANA	BASIN SURVEY	AM&DE	3.0	CI		.7	IL	ST. TRUCK	REAR CENT	YES	YES	(39)
3/23/81	150 EB	ROCK ISLAND	HCCORMACK TRAN	MIXED	22,716.8	MCI		.1	SC	SEMI	ALL	YES	YES	
3/26/81	170 WB	EFFINGHAM	YELLOW FRT.	SN124	250.0	MCI		2.0	CO	SEMI	RIGHT REAR	YES	YES	
4/03/81	170 WB	EFFINGHAM	HI COUNTRY C	HFP	6,224.0	UCI		10.0	CA	SEMI	MID RIGHT	YES	YES	
4/14/81	1-5 WB PLAZ	OAKBROOK	BEST TRAN	UNK	200.0	UCI		1.3	IL	SEMI	MIDDLE	YES	YES	(40)

APPENDIX A

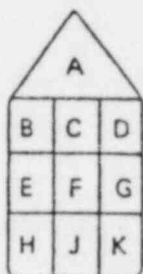
*Package Placement: The following diagrams appear on the state trooper's report form. The trooper marks the respective blocks on the drawing indicating the placement of radioactive material shipments. Whenever the package placement is stated on the above surveillance stops to be "all", the entire area was occupied, except the cab or driver's position. Most semi-trailer vehicles transporting LSA material were using the entire trailer area.



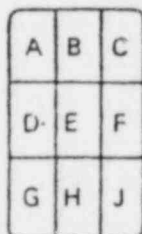
PASSENGER
CAR



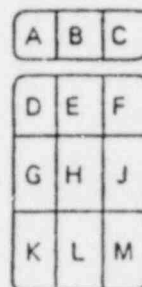
PICKUP



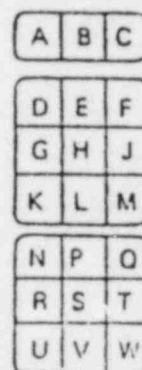
VAN



STRAIGHT
TRUCK



SEMI -
TRAILER



DOUBLE
BOTTOM

LOCATION OF RADIOACTIVE MATERIAL SHIPMENTS
BY CARRIER
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DATE	HOUR	LOCATION	CARRIER NAME	SHIPPER	SHIPPER STATE	MTRL CLASS	ISOTOPE	QUANTITY	QUAN UNIT	TOTAL TI	DOT NON COMPLY ITEMS
9/16/80	0115	OLD MANHEIM	AAA CARTAGE	SEAMAN NUC	WI	IND	RA-BE	4.5	MCI	1.0	
9/18/80	1725	OLD MANHEIM	AIRBORN FRT	AMERSHAM	IL	MED	MIXED	14,349.0	UCI	.3	
9/19/80	0740	LAWRENCE	AIR COUR	ROLO-U OF MO	MO	MED	MO-99	350.0	CI	2.4	(Yes)
9/17/80	1804	OLD MANHEIM	AIRBORN FRT	AMERSHAM	IL	MED	MIXED	57.1	MCI	2.6	
9/18/80	1145	OLD MANHEIM	BIT INC.	EBERLINE	NM	LSA	MIXED	.4	MCI	.4	(Yes)
9/13/80	1400	OLD MANHEIM	CASPERSON	MALINCKRODT	MO	MED	MIXED	19.0	CI	22.1	(Yes)
9/15/80	1715	OLD MANHEIM	CASPERSON	MEDI PHYSIC	IL	MED	TL201	1,508.1	MCI	1.2	(Yes)
9/15/80	1800	OLD MANHEIM	CASPERSON	MALINCKRODT	MO	MED	MIXED	3,062.1	MCI	15.2	(Yes)
9/15/80	2320	OLD MANHEIM	CASPERSON	MALINCKRODT	MO	MED	MIXED	592.0	MCI	.0	
9/16/80	2215	OLD MANHEIM	CASPERSON	MALINCKRODT	MO	MED	MO99	5.5	CI	6.3	
9/17/80	2220	LAWRENCE	CASPERSON	MALINCKRODT	MO	MED	I31&TL	250.0	MCI	1.0	
9/13/80	0855	OLD MANHEIM	CASPERSON	ST MARYS	WI	MED	MO99	441.0	MCI	.2	
9/19/80	1700	LAWRENCE	CASPERSON	MALINCKRODT	MO	MED	I,MO&P	106.6	CI	132.3	(Yes)
9/20/80	0750	HIGH&MT PRS	CASPERSON	MALINCKRODT	MO	MED	MIXED	114.8	CI	188.1	(Yes)
9/20/80	0215	LAWRENCE	CONTRACT COUR	N.E.N.	IL	MED	MIXED	5.6	CI	18.6	(Yes)
9/16/80	2320	OLD MANHEIM	FEDERAL EXP	UNKNOWN		MED	MIXED	5,186.5	MCI	1.1	(Yes)
9/18/80	0610	LAWRENCE	FEDERAL EXP	EBERHARDT	CA	IND	RA-BE	4.5	MCI	.5	
9/19/80	0550	LAWRENCE	FEDERAL EXP	VARIOUS		MED	MIXED	20.2	CI	2.6	
9/19/80	2305	OLD MANHEIM	FEDERAL EXP	PITTSBURG TES	IL	IND	IR-192	46.3	CI	1.5	
9/18/80	0350	LAWRENCE	KHS AIR FRT	WMU	MI	IND	RA-BE	4.5	MCI	.5	(Yes)
9/16/80	0500	KENNEDY	PARKSIDE MOTOR	SQUIBB	NJ	MED	MO&I31	12,489.0	MCI	10.7	(Yes)
9/16/80	1000	KENNEDY	PARKSIDE MOTOR	CORNING MED	MS	MED	UNK	.0	MCI	.0	(Yes)
9/17/80	0500	LAWRENCE	PARKSIDE MOTOR	SQUIBB	NJ	MED	I-131	1.4	MCI	.4	
9/15/80	1055	KENNEDY	PEABODY TEST	PEABODY TEST	IL	IND	IR-192	95.0	CI	1.3	(Yes)
9/17/80	2320	KENNEDY	PEABODY TEST	PEABODY	IL	IND	IR192	90.0	CI	.7	(Yes)
9/18/80	1733	KENNEDY	WB PEABODY TEST	PEABODY TEST	IL	IND	IR-192	80.0	CI	.9	
9/17/80	0420	LAWRENCE	PHARMOTOPE	UNION CARBID	NY	MED	MO99	10.8	CI	2.0	(Yes)
9/19/80	0440	LAWRENCE	PHARMOTOPE	UNION CARB	NY	MED	MO-99	16.6	CI	2.0	
9/13/80	1202	OLD MANHEIM	PRIVATE COUR	AMERSHAM	EN	MED	MIXED	.0	MCI	30.1	(Yes)
9/14/80	0905	KENNEDY	PRIVATE COUR	DIAG MEDI P	NJ	MED	MIXED	7,667.0	MCI	57.2	(Yes)
9/14/80	1400	OLD MANHEIM	PRIVATE COUR	MEDI PHYSICS	IL	MED	MIXED	1,680.0	MCI	10.2	
9/14/80	1637	OLD MANHEIM	PRIVATE COUR	MEDI PHYSIC	IL	MED	MIXED	1,046.0	MCI	9.2	
9/15/80	1418	OLD MANHEIM	PRIVATE COUR	MEDI PHYSIC	IL	MED	MIXED	14.1	MCI	1.7	
9/15/80	1725	HIGNS&MT PR	PRIVATE COUR	AMERSEAM	IL	MED	MIXED	505.0	MCI	4.8	
9/16/80	1000	OLD MANHEIM	PRIVATE COUR	MEDI PHYSIC	CA	MED	GA-67	507.0	MCI	8.2	
9/16/80	1130	LAWRENCE	PRIVATE COUR	NEN	NJ	MED	MIXED	3,345.0	MCI	4.8	
9/16/80	1319	OLD MANHEIM	PRIVATE COUR	MEDI PHYSIC	IL	MED	MIXED	197.3	MCI	1.8	
9/16/80	1405	OLD MANHEIM	PRIVATE COUR	MEDI PHYSICS	IL	MED	MIXED	140.2	MCI	1.7	
9/16/80	1442	OLD MANHEIM	PRIVATE COUR	MEDI PHYSIC	IL	MED	MIXED	413.7	MCI	2.4	
9/16/80	1725	HIGH&ARMSTR	PRIVATE COUR	AMERSHAM	IL	MED	MIXED	3.5	CI	6.5	(Yes)
9/16/80	2040	KENNEDY	PRIVATE COUR	AMERSHAM	IL	MED	NA-22	5.4	MCI	5.3	
9/17/80	1235	OLD MANHEIM	PRIVATE COUR	MEDI PHYSIC	IL	MED	NA&I23	30.2	MCI	1.2	
9/17/80	1350	KENNEDY	PRIVATE COUR	MEDI PHYSIC	IL	MED	MIXED	25.8	MCI	1.3	
9/17/80	1721	HIGH&ARMSTR	PRIVATE COUR	AMERSHAM	IL	MED	MIXED	129.3	MCI	2.9	(Yes)
9/18/80	0935	KENNEDY	PRIVATE COUR	AMERSHAM	EN	MED	MIXED	103.2	CI	25.8	
9/18/80	2304	LAWRENCE	PRIVATE COUR	UNION CARB	NY	MED	I-131	1,149.0	MCI	2.8	
9/19/80	0904	LAWRENCE	PRIVATE COUR	AMERSHAM	EN	MED	MIXED	860.0	MCI	3.2	(Yes)
9/19/80	1330	KENNEDY	PRIVATE COUR	AMERSHAM	IL	MED	MIXED	1,116.0	MCI	4.9	
9/15/80	1910	LAWRENCE	PUROLATOR	N.E.N.	IL	MED	TL&GA	26.0	MCI	.2	
9/19/80	1640	OLD MANHEIM	UNITED AIR	PHARMATOPE	IL	MED-WAS	MO-99	527.0	UCI	.3	

RADIOACTIVE MATERIAL SHIPMENTS
BY CARRIER AND SHIPPER
PREPARED FOR TRANSPORTATION CONTRACT WITH HRC & DOT

CARRIER NAME	CARRIER STATE	SHIPPER	SHIPPER STATE	CONSIGNEE	CONSIGNEE STATE	MTRL CLASS	ISOTOPE	QUANTITY	QUAN UNIT	TOTAL TI	DATE	DOT NON COMPLY ITEMS
AAA CARTAGE	WI	SEAMAN NUC	WI	SEAMAN NUC	WI	IND	RA-BE	4.5	MCI	1.0	9/16/80	
AIRBORH FRT	WA	AMERSHAM	IL	VARIOUS		MED	MIXED	14,349.0	UCI	.3	9/18/80	
AMF TUDOSCOPE	IL	AMF CARM	IL	VARIOUS	IL	IND	IR-192	3.2	CI	2.0	11/20/80	
ARK. BEST FRT	IL	HONESTAKE	CA	ALLIED CHEM	IL	LSA	U NAT	11,180.0	MCI	5.8	9/03/80	(Yes)
ARK. BEST FRT	IL	KERR MCGEE	MI	ALLIED CHEM	IL	LSA	U NAT	41,605.0	LBS	.0	9/03/80	(Yes)
ASSOC. COUR	MO	SQUIDD	NJ	ST. ANTHONY	IL	MED	MO-99	725.0	MCI	2.2	11/10/80	(Yes)
AIR COUR	MO	ROLO-U OF MO	MO	MEDI PHYSIC	IL	MED	MO-99	350.0	CI	2.4	9/19/80	(Yes)
AIRBORH FRT	WA	AMERSHAM	IL	VARIOUS		MED	MIXED	57.1	MCI	2.6	9/17/80	
BAGGETT TRAN	AL	SIERRA ARMY	CA	BKAH	NC	IND	U DEP	1,749.3	MCI	.4	7/17/80	
BASIN SURVEY	IL	BASIN SURVEY	IL	VARIOUS	IL	IND	AMIBE	3.0	CI	.7	3/19/81	(Yes)
BEST TRAN	IL	PROD. TOOL CO	IL	FERMI LAB	IL	LSA	UNK	200.0	UCI	1.3	4/14/81	(Yes)
BIT INC.	IL	EBERLINE	MI	C EDISON LAS	IL	LSA	MIXED	1.4	MCI	.4	9/18/80	(Yes)
CKH TRANS	TX	WESTINGHOUSE	SC	C EDISON Z10	IL	LSA	U-235	9,840.0	MCI	9.0	8/13/80	
CASPERSON	IL	MALINCKRODT	MO	VARIOUS	IL	MED	MIXED	19.0	CI	22.1	9/13/80	(Yes)
CASPERSON	IL	MALINCKRODT	MO	VARIOUS	IL	MED	MIXED	592.0	MCI	.0	9/15/80	
CASPERSON	IL	MALINCKRODT	MO	MALINCKRODT	MO	MED	MIXED	3,062.1	MCI	15.2	9/15/80	(Yes)
CASPERSON	IL	MALINCKRODT	MO	VARIOUS		MED	MO99	5.5	CI	6.3	9/16/80	
CASPERSON	IL	MALINCKRODT	MO	VARIOUS		MED	I311TL	250.0	MCI	1.0	9/17/80	
CASPERSON	IL	MALINCKRODT	MO	VARIOUS		MED	I. MO4P	106.6	CI	132.3	9/19/80	(Yes)
CASPERSON	IL	MALINCKRODT	MO	VARIOUS		MED	MIXED	114.8	CI	188.1	9/20/80	(Yes)
CASPERSON	IL	MALINCKRODT	MO	VARIOUS HOSP	IL	MED	MO4131	2,606.0	MCI	4.9	10/19/80	
CASPERSON	IL	MALINCKRODT	MO	VARIOUS		MED	MIXED	112.7	CI	189.8	12/20/80	(Yes)
CASPERSON	IL	MALINCKRODT	MO	MED DEL SER	NY	MED	I311MO	106.2	CI	106.2	12/26/80	
CASPERSON	IL	MALNKRISQUIB	MO	VARIOUS		MED	MIXED	27,210.0	MCI	59.3	1/31/81	(Yes)
CASPERSON	IL	MEDI PHYSIC	IL	MALINCKRODT	MO	MED	TL201	1,508.1	MCI	1.2	9/15/80	(Yes)
CASPERSON	IL	ST MARYS	WI	MALINCKRODT	MO	MED	MO99	441.0	MCI	.2	9/18/80	
CASPERSON	IL	VARIOUS HOSP		MALINCKRODT	MO	WAS-MED	MO-99	509.9	MCI	4.4	3/06/81	(Yes)
CENTURY GEO.	OK	CENT. GEO	OK	VARIOUS		IND	CS-137	125.0	MCI	.2	9/26/80	(Yes)
CHEM NUC	SC	C EDISON COR	IL	CHEM NUC	SC	WASTE	MIXED	8,750.0	MCI	.0	9/03/80	
CHEM NUC	SC	C EDISON COR	IL	CHEM NUC	SC	WASTE	MIXED	8,750.0	MCI	.0	9/03/80	
CHEM NUC	SC	OMAHA POWER	NE	CHEM NUC	SC	WASTE		4,146.0	MCI	.0	8/27/80	
CONAM	IL	CONAM	IL	VARIOUS		IND	IR-192	78.0	CI	1.5	1/05/81	
CONSOL FRT.	CA	AMERSHAM	IL	SCHLUNBERGER	TX	IND	CF-252	27.0	MCI	5.0	6/13/80	
CONTRACT COUR	IL	H.E.H.	IL	VARIOUS	I	MED	MIXED	5.6	CI	18.6	9/20/80	(Yes)
CONTRACT COUR	IL	H.E.H.	MA	VARIOUS HOSP	IL	MED	MIXED	15.0	CI	50.0	11/30/80	(Yes)
CONTRACT COUR	IL	H.E.H.	MA	VARIOUS		MED	MO99	55.4	CI	45.1	12/28/80	(Yes)
CROWN TRK	PA	NEVIS LABS	NY	FERMI LAB	IL	LSA	CO-60	.1	UCI	.0	3/12/81	(Yes)
DRESSER ATLAS	IL	D. ATLAS	IL	VARIOUS	IL	IND	AMIBE	4.5	CI	3.0	3/19/81	
DRESSER ATLAS	IL	DRESSER AT	IL	VARIOUS	IL	IND	CS&M	20.0	CI	10.0	11/12/80	
ELIOT LAKE FRT	OH	DENISON MINE	OH	ALLIED CHEM	IL	LSA	U NAT	5.8	CI	5.0	6/20/80	
ELIOT LAKE FRT	OH	DENISON MINE	OH	ALLIED CHEM	IL	LSA	U NAT	5.8	CI	5.0	7/22/80	
ELIOT LAKE FRT	OH	DENISON MINE	OH	ALLIED CHEM	IL	LSA	U NAT	5.8	CI	5.0	7/25/80	
FEDERAL EXP	WI	EBERHARDT	CA	SEAMAN	WI	IND	RA-BE	4.5	MCI	.5	9/18/80	
FEDERAL EXP	MO	GE NUC. CENTR	CA	CHRISTAN NE	MO	MED	XE-133	1.4	CI	.5	3/17/81	
FEDERAL EXP	IL	PITTSBURG TES	IL	GARMA IND	LA	IND	IR-192	46.3	CI	1.5	9/19/80	
FEDERAL EXP	TN	UNKHOIH		UNK COMP COD		MED	MIXED	5,186.5	MCI	1.1	9/16/80	(Yes)
FEDERAL EXP	WI	VARIOUS		VARIOUS		MED	MIXED	20.2	CI	2.6	9/19/80	
HACKE TRK.	IL	C EDISON COR	IL	CHEM NUC	SC	WASTE	MIXED	16,757.8	MCI	2.0	2/25/81	
HACKE TRK.	IL	C EDISON COR	IL	CHEM NUC	SC	WASTE	MIXED	10,449.9	MCI	6.0	12/04/80	

RADIOACTIVE MATERIAL SHIPMENTS
BY CARRIER AND SHIPPER
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

CARRIER NAME	CARRIER STATE	SHIPPER	SHIPPER STATE	CONSIGNEE	CONSIGNEE STATE	MTRL CLASS	ISOTOPE	QUANTITY	QUAN UNIT	TOTAL TI	DATE	DOT NON COMPLY ITEMS
HACKE TRK.	IL	C EDISON DRE	IL	CHEM NUC	SC	WASTE	MIXED	57,800.0	MCI	2.6	2/26/81	
HI COUNTRY C	CA	WESTINGHOUSE	PA	WESTINGHOUSE	CA	LSA	MFP	6,224.0	UCI	10.0	4/08/81	
HITMAN NUC	IL	C EDISON COR	IL	CHEM NUC	SC	WASTE	MIXED	19,832.9	MCI	32.0	8/13/80	
HITMAN NUC	IL	C EDISON MOR	IL	CHEM NUC	SC	WASTE	MIXED	1.0	CI	.0	7/21/80	
HITMAN NUC	IL	C EDISON DRE	IL	CHEM NUC	SC	WASTE	MIXED	4,604.0	MCI	20.0	6/09/80	
HITMAN NUC	NY	IONIA ELEC	IA	CHEM NUC	SC	WASTE	MIXED	83.0	MCI	.0	8/12/80	
HITMAN NUC FRT	MO	UNITED NUC	NM	ALLIED CHEM	IL	LSA	U HAT	10,140.0	MCI	.0	11/13/80	
KHS AIR FRT	IL	WMU	MI	SEANAH	WI	IND	RA-BE	4.5	MCI	.5	9/18/80	(Yes)
LEEWAY FRT.	OK	TEXAS NUC	TX	WESTVAC	PA	IND	CS-137	40.0	MCI	1.0	7/28/80	
MCCORMACK TRAH	HY	C EDISON MOR	IL	CHEM NUC	SC	WASTE	MIXED	80,720.0	MCI	.0	8/26/80	
MCCORMACK TRAH	NY	EDISON COR I	LC	HEM NUC	SC	LSA	MIXED	22,716.8	MCI	.1	3/23/81	
NL INDUSTRIES	NY	NL IND	NY	NUC ENG.	WA	WASTE	U-238	24.2	CI	20.0	8/22/80	
ORSCHLBN DR TR	MO	KAY RAY	IL	MONSANTO	MO	IND	CS-137	.0	CI	3.0	1/23/81	(Yes)
P.I.E.	CA	MONSANTO	OH	REYNOLD ELEC	NV	LSA	PU-238	1,820.9	MCI	.0	12/10/80	
PARKSIDE MOTOR	IL	CORNING MED	MS	ST MARYS	IN	MED	UNK	.0	MCI	.0	9/16/80	(Yes)
PARKSIDE MOTOR	IL	SQUIBB	NJ	VARIOUS	IL	MED	MOX131	12,489.0	MCI	10.7	9/16/80	(Yes)
PARKSIDE MOTOR	IL	SQUIBB	NJ	VA HOSPITAL	IL	MED	I-131	1.4	MCI	.4	9/17/80	
PEABODY TEST	IL	PEABODY	IL	O'HARE	IL	IND	IR192	90.0	CI	.7	9/17/80	(Yes)
PEABODY TEST	IL	PEABODY TEST	IL	O'HARE	IL	IND	IR-192	95.0	CI	1.3	9/15/80	(Yes)
PEABODY TEST	IL	PEABODY TEST	IL	O'HARE	IL	IND	IR-192	80.0	CI	.9	9/18/80	
PHARMOTOPE	IL	UNION CARB	NY	PHARMATOPE	IL	MED	MO-99	16.6	CI	2.0	9/19/80	
PHARMOTOPE	IL	UNION CARBID	NY	PHARMATOPE	IL	MED	MO99	10.8	CI	2.0	9/17/80	(Yes)
PRIVATE COUR	IL	AMERSHAM	EN	AMERSHAM	IL	MED	MIXED	.0	MCI	30.1	9/13/80	(Yes)
PRIVATE COUR	IL	AMERSHAM	IL	VARIOUS	IL	MED	MIXED	505.0	MCI	4.8	9/15/80	
PRIVATE COUR	IL	AMERSHAM	IL	VARIOUS	IL	MED	NA-22	5.4	MCI	5.3	9/16/80	
PRIVATE COUR	IL	AMERSHAM	IL	VARIOUS	IL	MED	MIXED	3.5	CI	6.5	9/16/80	(Yes)
PRIVATE COUR	IL	AMERSHAM	IL	METCOR	NJ	MED	MIXED	129.3	MCI	2.9	9/17/80	(Yes)
PRIVATE COUR	IL	AMERSHAM	EN	AMERSHAM	IL	MED	MIXED	103.2	CI	25.8	9/18/80	
PRIVATE COUR	IL	AMERSHAM	IL	AMERSHAM	IL	MED	MIXED	860.0	MCI	3.2	9/19/80	(Yes)
PRIVATE COUR	IL	AMERSHAM	ON	AMERSHAM	ON	MED	MIXED	1,116.0	MCI	4.9	9/19/80	
PRIVATE COUR	IL	DIAG MEDI P	NJ	MEDI PHYSICS	IL	MED	MIXED	7,667.0	MCI	57.2	9/14/80	(Yes)
PRIVATE COUR	IL	MEDI PHYSIC	IL	VARIOUS	IL	MED	MIXED	1,046.0	MCI	9.2	9/14/80	
PRIVATE COUR	IL	MEDI PHYSIC	IL	VARIOUS	IL	MED	MIXED	14.1	MCI	1.7	9/15/80	
PRIVATE COUR	IL	MEDI PHYSIC	IL	VARIOUS	IL	MED	MIXED	413.7	MCI	2.4	9/16/80	
PRIVATE COUR	IL	MEDI PHYSIC	CA	MEDI PHYSIC	IL	MED	GA-67	507.0	MCI	8.2	9/16/80	
PRIVATE COUR	IL	MEDI PHYSIC	IL	VARIOUS	IL	MED	MIXED	197.3	MCI	1.8	9/16/80	
PRIVATE COUR	IL	MEDI PHYSIC	IL	PUROLATOR	FA	MED	MIXED	25.8	MCI	1.3	9/17/80	
PRIVATE COUR	IL	MEDI PHYSIC	IL	VARIOUS	IL	MED	NA&I23	30.2	MCI	1.2	9/17/80	
PRIVATE COUR	IL	MEDI PHYSICS	IL	VARIOUS	IL	MED	MIXED	1,680.0	MCI	10.2	9/14/80	
PRIVATE COUR	IL	MEDI PHYSICS	IL	VARIOUS	IL	MED	MIXED	140.2	MCI	1.7	9/16/80	
PRIVATE COUR	IL	NEN	NJ	NEN	IL	MED	MIXED	3,345.0	MCI	4.8	9/16/80	
PRIVATE COUR	IL	UNION CARB	NY	ABBOTT LBAS	IL	MED	I-131	1,149.0	MCI	2.8	9/18/80	
PURULATOR	NY	N.E.N.	IL	KEOKUK HOSP	IA	MED	IL131	26.0	MCI	.2	9/15/80	
QUAD CITY TEST	IA	QUAD CITY T	IA	VARIOUS	IL	IND	IR-192	58.0	CI	1.2	1/29/81	(Yes)
REESE&ASSOC	IL	REESE&ASSOC	IL	VARIOUS	IL	IND	CS-AM	50.0	MCI	.1	11/06/80	
RYDER RANGER	FL	NUC. METALS	MA	U.S. ECOLOGY	WA	LSA	U DEP	720.0	MCI	.0	2/05/81	(Yes)
KYDE RANGER	FL	RHI CO.	OH	ACROJET METL	CA	LSA	U DEP	56.0	MCI	.1	10/31/80	
RYDER TRK	FL	K RAYMAG. IN	IL	VULCAN&GAMMA	LA	IND	IR&CS	500.0	MCI	.3	3/12/81	(Yes)
SUP. IND. X-RAY	IL	SUP IND	IL	VARIOUS	IL	IND	IR-192	33.0	CI	1.8	9/29/80	(Yes)

APPENDIX A

RADIOACTIVE MATERIAL SHIPMENTS
BY CARRIER AND SHIPPER
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

CARRIER NAME	CARRIER STATE	SHIPPER	SHIPPER STATE	CONSIGNEE	CONSIGNEE STATE	MTRL CLASS	ISOTOPE	QUANTITY	QUAN UNIT	TOTAL TI	DATE	DOT NON COMPLY ITEMS
SUP. IND. X-RAY	IL	SUP IND	IL	VARIOUS		IND	IR-192	30.0	CI	.5	11/03/80	
TRI STATE	MO	ARGON NAT LB	IL	E.G. IG	ID	LSA	PU-239	13.4	CI	6.0	8/22/80	
TRI STATE	MO	ARGON NAT LB	IL	E.G. IG.	ID	LSA	MFP	29,000.0	LBS	1.5	9/10/80	
TRI STATE	MO	EG&G IDAHO	ID	BETTIS LAB	PA	LSA	U235CO	49.6	CI	.3	3/05/81	
TRI STATE	MO	EXXON	NY	ALLIED CHEM	IL	LSA	U NAT	2.5	CI	.0	6/20/80	
TRI STATE	MO	EXXON	WA	I.T.O. BERTH	NJ	LSA	U-235	6,920.0	MCI	28.8	8/25/80	
TRI STATE	MO	G.E. MORRIS	IL	NUC ENG. CO	NV	WASTE	MIXED	157.8	MCI	7.0	9/24/80	
TRI STATE	MO	KERR-MCGEE	OK	D.O.E.	OH	LSA	UF6	3.0	CI	3.0	6/25/80	
TRI STATE	MO	H.E. NUC	CT	H.E.CO.	WA	WASTE	MIXED	19,320.0	UCI	.0	12/31/80	
TRI STATE	IL	N.E.H.	MA	NUC ENG.	NV	WASTE	MIXED	8,192.7	MCI	15.0	10/17/80	
TRI STATE	MO	RADIAC RES	NY	H.E.CO.	WA	WASTE	TC99M	36,447.0	LBS	4.5	12/31/80	
TRI STATE	MO	TELEDYNE	NY	HECO	WA	WASTE	MIXED	457.9	MCI	.0	1/08/81	
TRI STATE	MO	TELEDYNE	NJ	NUC ENG	WA	WASTE	MIXED	821.0	MCI	.0	12/07/80	
TRI STATE	MO	WESTINGHOUSE	PA	USD.O.E.	WA	LSA	U&PU	100.0	MCI	.1	2/09/81	
UNITED AIR	IL	PHARITADPE	IL	UNION CARB N	YO	MED-WAS	MO-99	527.0	UCI	.3	9/19/80	
WIS. IND. TEST	WI	WIS IND	WI	VARIOUS		IND	IR-192	25.0	CI	1.1	10/02/80	(Yes)
WIS. IND. TEST	WI	WIS IND	WI	VARIOUS		IND	IR-192	20.0	CI	.0	10/20/80	(Yes)
YELLOW FRT.	IH	BRUSH WILMAN	OH	BOULDER SCI	CO	IND	SB124	250.0	MCI	2.0	3/26/81	
YELLOW FRT.	KA	RIO ALGOM	UT	ALLIED CHEM	IL	LSA	U NAT	21,667.0	LBS	.0	6/19/80	(Yes)

APPENDIX B

O'HARE STUDY

APPENDIX B

O'HARE INTERNATIONAL AIRPORT SURVEILLANCE STUDY

The fourth year surveillance program's contract performed for the United States Nuclear Regulatory Commission (USNRC) and the United States Department of Transportation (USDOT) made provisions for a seven day, twenty-four hour surveillance study to be conducted at O'Hare International Airport located in Chicago, Illinois. Information related to package condition, handling practices, adherence to transportation regulations, and other pertinent data acquired from vehicle inspections.

Twenty-one Illinois State Police troopers, familiar with USDOT regulations regarding hazardous materials, were the investigators and inspectors for the surveillance program. Accompanying the state troopers during each shift were representatives from the Illinois Department of Nuclear Safety, who assisted during surveillance inspections and provided expertise on radioactive materials. The data in this special report consists of the information supplied by the state troopers as a result of their activity at O'Hare Airport.

The objective of this study was to determine the level of compliance with the USDOT regulations governing transportation of radioactive materials, especially among the radiopharmaceutical carriers. The level of compliance was 60% for the 50 surveillance stops occurring during the week of September 13, 1980.

During the surveillance period from September 13 at 8:30 a.m. to September 20 at 8:00 a.m., 50 surveillance stops were performed. Three additional stops occurred that did not require a radiation survey due to empty vehicles being placarded "radioactive". The busiest day of the week was Tuesday in which 12 surveillance stops occurred. Several stops were made during the week by troopers involving other hazardous materials violations (i.e., vehicle transporting flammables not properly placarded, etc.). Forty percent of all stops occurred in the morning with 14% around 5:00 p.m.

APPENDIX B

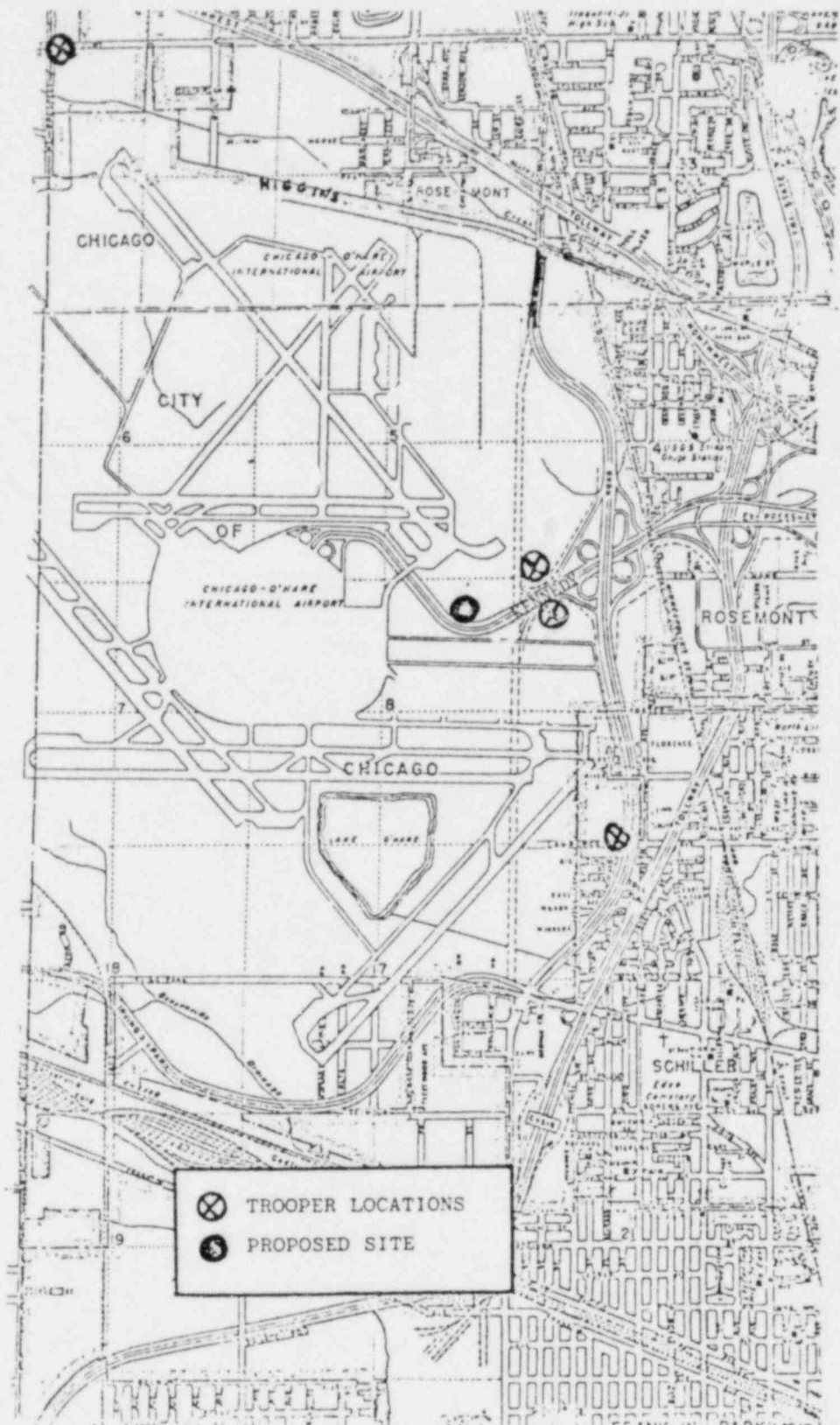
The following computer data sort indicates that most vehicles transporting radioactive materials enter or leave the O'Hare Cargo Terminal area by either Old Manheim Road which is accessible from Lawrence Avenue or from the Kennedy Expressway and Lawrence Avenue. As indicated before, more surveys were conducted around 5:00 p.m. due to incoming and outgoing air flights. The number of surveillance stops conducted per carrier during the study is listed on page 26.

NUMBER OF RADIATION SURVEILLANCE STOPS BY HOUR AND LOCATION PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

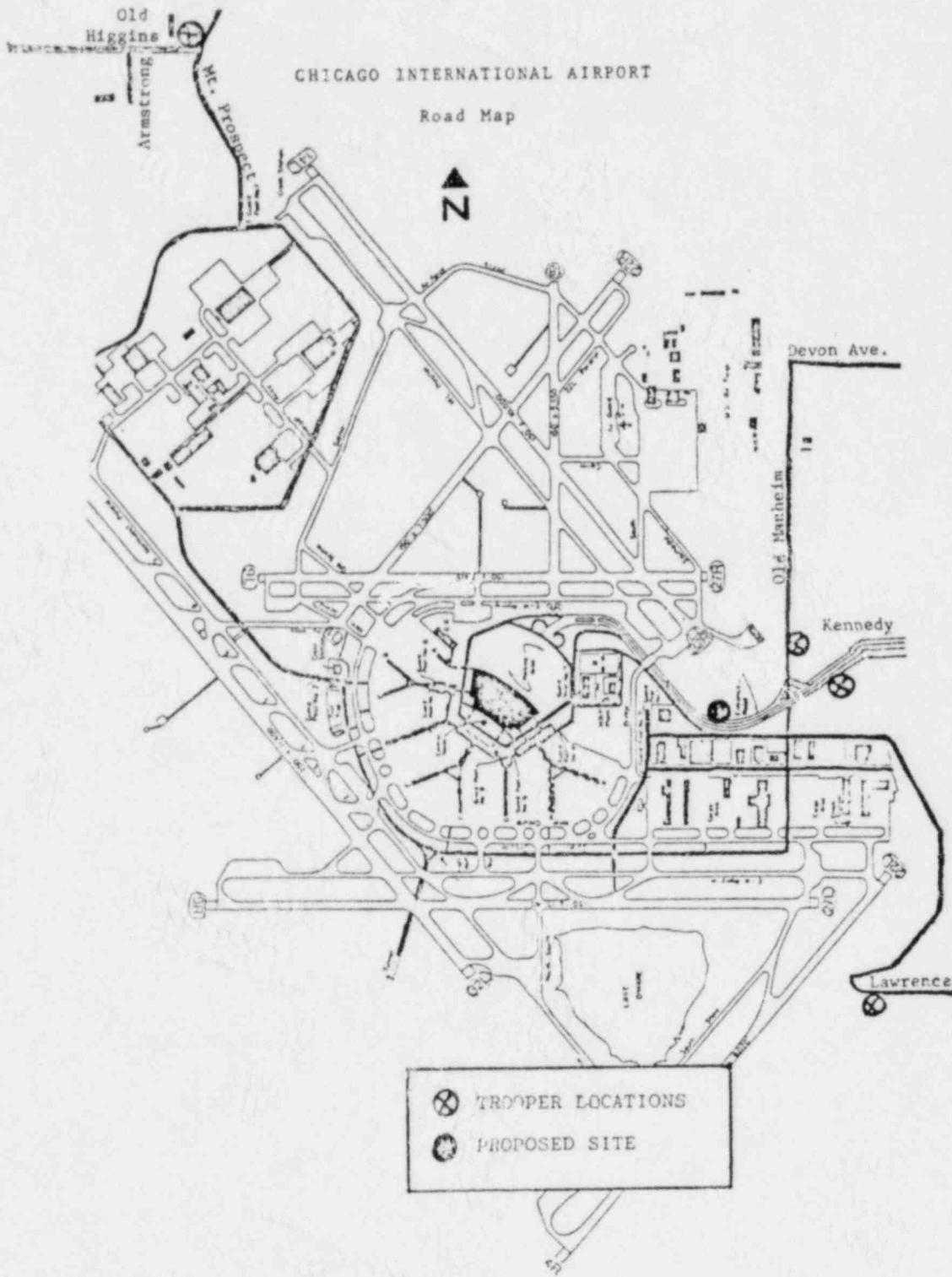
HOUR	DATE	LOCATION	CARRIER NAME
0115	9/16/80	OLD MANHEIM	AAA CARTAGE
0215	9/20/80	LAWRENCE	CONTRACT COUR
0350	9/18/80	LAWRENCE	KHS AIR FRT
0420	9/17/80	LAWRENCE	PHARMOTOPE
0440	9/19/80	LAWRENCE	PHARMOTOPE
0500	9/16/80	KENNEDY	PARKSIDE MOTOR
0500	9/17/80	LAWRENCE	PARKSIDE MOTOR
0550	9/19/80	LAWRENCE	FEDERAL EXP
0610	9/18/80	LAWRENCE	FEDERAL EXP
0740	9/19/80	LAWRENCE	AIR COUR
0750	9/20/80	HIGH&MT PRS	CASPERSON
0855	9/18/80	OLD MANHEIM	CASPERSON
0904	9/19/80	LAWRENCE	PRIVATE COUR
0905	9/14/80	KENNEDY	PRIVATE COUR
0935	9/18/80	KENNEDY	PRIVATE COUR
1000	9/16/80	KENNEDY	PARKSIDE MOTOR
1000	9/16/80	OLD MANHEIM	PRIVATE COUR
1055	9/15/80	KENNEDY	PEABODY TEST
1130	9/16/80	LAWRENCE	PRIVATE COUR
1145	9/18/80	OLD MANHEIM	BIT INC.
1202	9/13/80	OLD MANHEIM	PRIVATE COUR
1235	9/17/80	OLD MANHEIM	PRIVATE COUR
1319	9/16/80	OLD MANHEIM	PRIVATE COUR
1330	9/19/80	KENNEDY	PRIVATE COUR
1350	9/17/80	KENNEDY	PRIVATE COUR
1400	9/13/80	OLD MANHEIM	CASPERSON
1400	9/14/80	OLD MANHEIM	PRIVATE COUR
1405	9/16/80	OLD MANHEIM	PRIVATE COUR
1418	9/15/80	OLD MANHEIM	PRIVATE COUR
1442	9/16/80	OLD MANHEIM	PRIVATE COUR
1637	9/14/80	OLD MANHEIM	PRIVATE COUR
1640	9/19/80	OLD MANHEIM	UNITED AIR
1700	9/19/80	LAWRENCE	CASPERSON
1715	9/15/80	OLD MANHEIM	CASPERSON
1721	9/17/80	HIGH&ARMSTR	PRIVATE COUR
1725	9/16/80	HIGH&ARMSTR	PRIVATE COUR
1725	9/15/80	HIGNS&MT PR	PRIVATE COUR
1725	9/18/80	OLD MANHEIM	AIRBORN FRT
1733	9/18/80	KENNEDY WB	PEABODY TEST
1800	9/15/80	OLD MANHEIM	CASPERSON
1804	9/17/80	OLD MANHEIM	AIRBORN FRT
1910	9/15/80	LAWRENCE	PUROLATOR
2040	9/16/80	KENNEDY	PRIVATE COUR
2215	9/16/80	OLD MANHEIM	CASPERSON
2220	9/17/80	LAWRENCE	CASPERSON
2304	9/18/80	LAWRENCE	PRIVATE COUR
2305	9/19/80	OLD MANHEIM	FEDERAL EXP
2320	9/17/80	KENNEDY	PEABODY TEST
2320	9/15/80	OLD MANHEIM	CASPERSON
2320	9/16/80	OLD MANHEIM	FEDERAL EXP

THE FOLLOWING MAPS SHOW THE LOCATIONS AT WHICH THE TROOPERS WERE STATIONED AROUND O'HARE INTERNATIONAL AIRPORT. AN ADDITIONAL SITE IS ALSO INDICATED ON THE MAP SHOULD THIS STUDY BE REPEATED IN THE O'HARE AREA.

APPENDIX B



APPENDIX B



APPENDIX B

Vehicle types noted during the surveillance stops were: five passenger cars transporting radiopharmaceuticals; five pick-up vehicles used to transport radiopharmaceuticals and industrial radiography gamma cameras; three semi-trailer vehicles transporting industrial moisture-density gauges and one 350 curie molybdenum-99 generator; 15 straight trucks transporting radiopharmaceuticals; and 22 vans transporting radiopharmaceuticals.

The carriers involved in the surveillance stops were of the following categories: 72% common carriers; 16% contract carriers, and 12% private carriers. Sixteen percent of the carriers' vehicles were of the exclusive-use type.

The normal physical form (i.e., gas, liquid, solid) in which the radioactive material shipments occurred was 22% solid, 44% liquid, and 34% mixture.

Ten shipments contained radioactive material in special form. Of this, four were industrial radiography gamma cameras, three were moisture-density gauges, and three were radiopharmaceutical shipments.

The average total Transport Index indicated on shipping papers and/or determined by the troopers was 12.05 for the 50 surveillance stops, ranging from 0.2 to 183.1. There were three shipments in which the total Transport Index exceeded 50; one carrier provided papers indicating the shipment was exclusive-use even though the criteria for exclusive-use were not met.

The following data sort shows the surveillance stops occurring per day as well as the radiation levels around the vehicle and the total TI of the radioactive material shipments.

RADIOACTIVE MATERIAL SHIPMENTS & RADIATION LEVELS
 BY DATE AND TIME
 PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DATE	LOCATION	HOUR	CARRIER NAME	ISOTOPE	QUANTITY	QUAN UNIT	CAB LEVEL MR/HR	SURFACE LEVEL MR/HR	SIX FT LEVEL MR/HR	TOTAL TI
9/13/80	OLD MANHEIM	1202	PRIVATE COUR	MIXED	.0	MCI	.0	8.0	.0	30.1
9/13/80	OLD MANHEIM	1400	CASPERSON	MIXED	19.0	CI	17.0	31.0	.0	22.1
9/14/80	KENNEDY	0905	PRIVATE COUR	MIXED	7,667.0	MCI	1.0	18.0	1.0	57.2
9/14/80	OLD MANHEIM	1400	PRIVATE COUR	MIXED	1,680.0	MCI	.8	3.8	.0	10.2
9/14/80	OLD MANHEIM	1637	PRIVATE COUR	MIXED	1,046.0	MCI	.6	3.5	.5	9.2
9/15/80	KENNEDY	1055	PEABODY TEST	IR-192	95.0	CI	.2	11.0	.0	1.3
9/15/80	OLD MANHEIM	1418	PRIVATE COUR	MIXED	14.1	MCI	.3	2.3	.0	1.7
9/15/80	OLD MANHEIM	1715	CASPERSON	TL201	1,508.1	MCI	.1	3.5	.0	1.2
9/15/80	HIGNS&MT PR	1725	PRIVATE COUR	MIXED	505.0	MCI	.1	1.5	.0	4.8
9/15/80	OLD MANHEIM	1800	CASPERSON	MIXED	3,062.1	MCI	.0	.0	.0	15.2
9/15/80	LAWRENCE	1910	PURULATOR	TL&GA	26.0	MCI	.3	.3	.0	.2
9/15/80	OLD MANHEIM	2320	CASPERSON	MIXED	592.0	MCI	.3	13.0	.4	.0
9/16/80	OLD MANHEIM	0115	AAA CARTAGE	RA-BE	4.5	MCI	.0	.3	.0	1.0
9/16/80	KENNEDY	0500	PARKSIDE MOTOR	MO&I31	12,489.0	MCI	1.3	7.0	.0	10.7
9/16/80	KENNEDY	1000	PARKSIDE MOTOR	UNK	.0	MCI	.0	.0	.0	.0
9/16/80	OLD MANHEIM	1000	PRIVATE COUR	GA-67	507.0	MCI	.5	4.8	.0	8.2
9/16/80	LAWRENCE	1130	PRIVATE COUR	MIXED	3,345.0	MCI	.1	.2	.0	4.8
9/16/80	OLD MANHEIM	1319	PRIVATE COUR	MIXED	197.3	MCI	.4	1.0	.0	1.8
9/16/80	OLD MANHEIM	1405	PRIVATE COUR	MIXED	140.2	MCI	.5	.7	.0	1.7
9/16/80	OLD MANHEIM	1442	PRIVATE COUR	MIXED	413.7	MCI	.6	2.5	.0	2.4
9/16/80	HIGN&ARMSTR	1725	PRIVATE COUR	MIXED	3.5	CI	.1	2.0	.0	6.5
9/16/80	KENNEDY	2040	PRIVATE COUR	NA-22	5.4	MCI	.1	1.0	.0	5.3
9/16/80	OLD MANHEIM	2215	CASPERSON	MO99	5.5	CI	2.0	6.0	.0	6.3
9/16/80	OLD MANHEIM	2320	FEDERAL EXP	MIXED	5,186.5	MCI	.1	.4	.0	1.1
9/17/80	LAWRENCE	0420	PHARMOTOPE	MO99	10.8	CI	.5	5.0	.0	2.0
9/17/80	LAWRENCE	0500	PARKSIDE MOTOR	I-131	1.4	MCI	.0	2.5	.0	.4
9/17/80	OLD MANHEIM	1235	PRIVATE COUR	NA&I23	30.2	MCI	.1	.8	.0	1.2
9/17/80	KENNEDY	1350	PRIVATE COUR	MIXED	25.8	MCI	1.1	1.3	.0	1.3
9/17/80	HIGN&ARMSTR	1721	PRIVATE COUR	MIXED	129.3	MCI	.1	.7	.0	2.9
9/17/80	OLD MANHEIM	1804	AIRBORN FRT	MIXED	57.1	MCI	.1	.3	.0	2.6
9/17/80	LAWRENCE	2220	CASPERSON	I31&TL	250.0	MCI	.1	.5	.0	1.0
9/17/80	KENNEDY	2320	PEABODY TEST	IR192	90.0	CI	.2	10.0	.4	.7
9/18/80	LAWRENCE	0350	KHS AIR FRT	RA-BE	4.5	MCI	.0	9.5	.0	.5
9/18/80	LAWRENCE	0610	FEDEPAL EXP	RA-BE	4.5	MCI	.1	.2	.0	.5
9/18/80	OLD MANHEIM	0855	CASPERSON	MO99	441.0	MCI	.0	.1	.0	.2
9/18/80	KENNEDY	0935	PRIVATE COUR	MIXED	103.2	CI	.6	10.0	3.0	25.8
9/18/80	OLD MANHEIM	1145	BIT INC.	MIXED	.4	MCI	.1	.2	.0	.4
9/18/80	OLD MANHEIM	1725	AIRBORN FRT	MIXED	14,349.0	UCI	.1	.1	.0	.3
9/18/80	KENNEDY WB	1733	PEABODY TEST	IR-192	80.0	CI	.0	1.2	.0	.9
9/18/80	LAWRENCE	2304	PRIVATE COUR	I-131	1,149.0	MCI	.5	2.4	.0	2.8
9/19/80	LAWRENCE	0440	PHARMOTOPE	MO-99	16.6	CI	.4	2.5	.3	2.0
9/19/80	LAWRENCE	0550	FEDERAL EXP	MIXED	20.2	CI	.3	.5	.0	2.6
9/19/80	LAWRENCE	0740	AIR COUR	MO-99	350.0	CI	.1	10.5	.0	2.4
9/19/80	LAWRENCE	0904	PRIVATE COUR	MIXED	860.0	MCI	.1	.3	.0	3.2
9/19/80	KENNEDY	1330	PRIVATE COUR	MIXED	1,116.0	MCI	1.0	4.7	3.5	4.9
9/19/80	OLD MANHEIM	1640	UNITED AIR	MO-99	527.0	UCI	1.0	1.0	.0	.3
9/19/80	LAWRENCE	1700	CASPERSON	I,MO&P	106.6	CI	1.0	55.0	7.0	132.3
9/19/80	OLD MANHEIM	2305	FEDERAL EXP	IR-192	46.3	CI	.0	1.0	.0	1.5
9/20/80	LAWRENCE	0215	CONTRACT COUR	MIXED	5.6	CI	.0	15.0	.0	18.6
9/20/80	HIGN&MT PRS	0750	CASPERSON	MIXED	114.8	CI	2.4	80.0	12.0	188.1

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The cab areas of the vehicles were monitored with an ionization survey instrument. The average result for the normally occupied area within the vehicles was 0.926 mR/hr for the 50 vehicles stopped. The radiation levels in the cabs of two vehicles exceeded the 2 mR/hr limit, and were 10.0 mR/hr and 17.0 mR/hr respectively. In both cases, the packages were moved to other areas within the vehicles to reduce the radiation level below 2.0 mR/hr in the cab area.

The outside surface of the vehicles stopped were monitored and resulted in a maximum average level of 8.742 mR/hr with a range from background to 80 mR/hr. The 80 mR/hr surface reading was obtained on a vehicle containing over 203 packages of radiopharmaceuticals with a total Transport Index of 188.1.

The average total activity for the radioactive materials intransit was 22.191 curies per shipment. The following computer sort shows the isotope, quantity per shipment by material classification (i.e., IND-industrial devices, LSA, MED-radiopharmaceuticals).

RADIOACTIVE MATERIAL SHIPMENT QUANTITIES
BY MATERIAL CLASS AND ISOTOPE
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS
IR-192	46.3	CI	IND
IR-192	80.0	CI	IND
IR-192	95.0	CI	IND
IR192	90.0	CI	IND
RA-BE	4.5	MCI	IND
RA-DE	4.5	MCI	IND
RA-BE	4.5	MCI	IND
MIXED	.4	MCI	LSA
GA-67	507.0	MCI	MED
I-131	1.4	MCI	MED
I-131	1,149.0	MCI	MED
I,MO&P	106.6	CI	MED
I31&TL	250.0	MCI	MED
MIXED	.0	MCI	MED
MIXED	3.5	CI	MED
MIXED	5.6	CI	MED
MIXED	14.1	MCI	MED
MIXED	19.0	CI	MED
MIXED	20.2	CI	MED
MIXED	25.8	MCI	MED
MIXED	57.1	MCI	MED
MIXED	103.2	CI	MED
MIXED	114.8	CI	MED
MIXED	129.3	MCI	MED
MIXED	140.2	MCI	MED
MIXED	197.3	MCI	MED
MIXED	413.7	MCI	MED
MIXED	505.0	MCI	MED
MIXED	592.0	MCI	MED
MIXED	860.0	MCI	MED
MIXED	1,046.0	MCI	MED
MIXED	1,116.0	MCI	MED

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RADIOACTIVE MATERIAL SHIPMENT QUANTITIES
 BY MATERIAL CLASS AND ISOTOPE
 PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS
MIXED	1,680.0	MCI	MED
MIXED	3,062.1	MCI	MED
MIXED	3,345.0	MCI	MED
MIXED	5,186.5	MCI	MED
MIXED	7,667.0	MCI	MED
MIXED	14,349.0	UCI	MED
MO&I31	12,489.0	MCI	MED
MO-99	16.6	CI	MED
MO-99	350.0	CI	MED
MO99	5.5	CI	MED
MO99	10.8	CI	MED
MO99	441.0	MCI	MED
NA&I23	30.2	MCI	MED
NA-22	5.4	MCI	MED
TL&GA	26.0	MCI	MED
TL201	1,503.1	MCI	MED
UNK	.0	MCI	MED
MO-99	527.0	UCI	MED-WAS

Improper and inaccessible shipping papers, over-labeling of packages (i.e., Yellow III label on package when Transport Index indicated Yellow II or White I needed), packages not blocked and braced, TI in excess of 50, improper placarding, and a shipper's certification missing from the shipping papers were the frequent items found in non-compliance with DOT regulations.

Improper placarding involved nine vehicles where either a placard was missing or none were available. In one instance, the trooper drove the driver of a vehicle to a cargo terminal at the airport to obtain four placards. In most instances, the placards were lying on the dashboard of the vehicles.

The following computer listing, Radiation Surveillance Stops, presents data from the troopers' investigations, including DOT non-compliance items found. (Refer to page 39 for an explanation of DOT non-compliance items and exceptions.)

RADIATION SURVEILLANCE STOPS
BY DATE AND LOCATION
PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DATE	LOCATION	TROOPER	ISOTOPE	QUANTITY	QUAN UNIT	NO. PACK INSPEC	TOTAL TI	DESTIN ATION STATE	VEHICLE TYPE	PACKAGE PLACE	SHIP PAPER	PROP PLAC	DOT NON COMPLY ITEMS
9/13/80	OLD MANHEIM	STEIBER	MIXED	19.0	CI		22.1	IL	PICK-UP	MID&LEFT	YES	YES	(1)
9/13/80	OLD MANHEIM	STEIBER	MIXED	.0	MCI		30.1	IL	ST. TRUCK	ALL	YES	YES	(2)
9/14/80	KENNEDY	ASHBY	MIXED	7,667.0	MCI		57.2	IL	VAN	L&MID REAR	YES	YES	(3)
9/14/80	OLD MANHEIM	STEIBER	MIXED	1,680.0	MCI	3	10.2		VAN	REAR	YES	YES	
9/14/80	OLD MANHEIM	PERSON	MIXED	1,046.0	MCI	2	9.2		VAN	MID & REAR	YES	YES	
9/15/80	HIGN&MT PR	MUELLER	MIXED	505.0	MCI	1	4.8		ST. TRUCK	REAR	YES	YES	
9/15/80	KENNEDY	GOMORA	IR-192	95.0	CI		1.3	IL	PICK-UP	MID RIGHT	YES	NO	(4)
9/15/80	LAWRENCE	KARNETT	TL&GA	26.0	MCI	5	.2	IA	VAN	REAR LEFT	YES	N/A	
9/15/80	OLD MANHEIM	PERSON	MIXED	592.0	MCI		.0	IL	VAN	REAR LEFT	YES	YES	
9/15/80	OLD MANHEIM	PERSON	MIXED	3,062.1	MCI	2	15.2	MO	VAN	REAR	YES	YES	(5)
9/15/80	OLD MANHEIM	PERSON	TL201	1,508.1	MCI		1.2	MO	VAN	REAR	YES	NO	(6)
9/15/80	OLD MANHEIM	STEIBER	MIXED	14.1	MCI	3	1.7		VAN	REAR	YES	N/A	
9/16/80	HIGN&ARMSTR	MUELLER	MIXED	3.5	CI	1	6.5		ST. TRUCK	REAR	YES	YES	(7)
9/16/80	KENNEDY	GOMORA	NA-22	5.4	MCI		5.3		VAN	REAR CENT	YES	YES	
9/16/80	KENNEDY	ASHBY	UNK	.0	MCI		.0	IN	PICK-UP	FRONT R	YES	NO	(8)
9/16/80	KENNEDY	HENEISE	MO&I31	12,489.0	MCI	2	10.7	IL	AUTO	REAR	YES	NO	(9)
9/16/80	LAWRENCE	GOFORTH	MIXED	3,345.0	MCI		4.8	IL	ST. TRUCK	L MID&REAR	YES	YES	
9/16/80	OLD MANHEIM	STEIBER	MIXED	197.3	MCI	1	1.8		VAN	REAR	YES	N/A	
9/16/80	OLD MANHEIM	STEIBER	GA-67	507.0	MCI	3	8.2	IL	VAN	REAR	YES	YES	
9/16/80	OLD MANHEIM	STEIBER	MIXED	413.7	MCI		2.4		VAN	REAR	YES	N/A	
9/16/80	OLD MANHEIM	STEIBER	MIXED	140.2	MCI		1.7		VAN	REAR MID&R	YES	N/A	
9/16/80	OLD MANHEIM	CAREY	RA-BE	4.5	MCI	1	1.0	WI	SEMI	MID RIGHT	YES	N/A	
9/16/80	OLD MANHEIM	MYERS	MIXED	5,186.5	MCI		1.1		ST. TRUCK	R&MID MID	YES	NO	(10)
9/16/80	OLD MANHEIM	PERSON	MO99	5.5	CI		6.3		VAN	MIDDLE	YES	YES	
9/17/80	HIGN&ARMSTR	BUSH	MIXED	129.3	MCI	1	2.9	NJ	ST. TRUCK	REAR RIGHT	YES	YES	(11)
9/17/80	KENNEDY	SCHAEFER	MIXED	25.8	MCI		1.3	FA	VAN	REAR	YES	YES	
9/17/80	KENNEDY	BUSH	IR192	90.0	CI	1	.7	IL	PICK-UP	MID RIGHT	YES	YES	(12)
9/17/80	LAWRENCE	STYGAR	I31&TL	250.0	MCI	5	1.0		VAN	MID&REAR L	YES	YES	
9/17/80	LAWRENCE	BEIN	I-131	1.4	MCI	1	.4	IL	AUTO	REAR CENT	YES	YES	
9/17/80	LAWRENCE	CAREY	MO99	10.8	CI	1	2.0	IL	AUTO	REAR CENT	YES	NO	(13)
9/17/80	OLD MANHEIM	DEBAUN	HA&I23	30.2	MCI		1.2		VAN	REAR	YES	YES	
9/17/80	OLD MANHEIM	MYERS	MIXED	57.1	MCI		2.6		ST. TRUCK	MIDDLE	YES	YES	
9/18/80	KENNEDY	SCHAEFER	MIXED	103.2	CI		25.8	IL	ST. TRUCK	REAR	YES	YES	
9/18/80	KENNEDY WB	BUSH	IR-192	80.0	CI		.9	IL	PICK-UP	MID RIGHT	YES	YES	
9/18/80	LAWRENCE	ANDREWS	I-131	1,149.0	MCI		2.8	IL	VAN	REAR CENT	YES	YES	
9/18/80	LAWRENCE	CAREY	RA-BE	4.5	MCI	1	.5	WI	ST. TRUCK	REAR CENT	YES	N/A	
9/18/80	LAWRENCE	JOHNSON	RA-BE	4.5	MCI	1	.5	WI	SEMI	REAR CENT	YES	N/A	(14)
9/18/80	OLD MANHEIM	POMYKALA	MO99	441.0	MCI	1	.2	MO	VAN	REAR LEFT	YES	N/A	
9/18/80	OLD MANHEIM	MYERS	MIXED	14,349.0	UCI		.3		ST. TRUCK	REAR RIGHT	YES	N/A	
9/18/80	OLD MANHEIM	DEBAUN	MIXED	.4	MCI	1	.4	IL	ST. TRUCK	MID RIGHT	YES	NO	(15)
9/19/80	KENNEDY	SCHAEFER	MIXED	1,116.0	MCI	5	4.9	OH	VAN	REAR	YES	YES	
9/19/80	LAWRENCE	ANDREWS	MIXED	860.0	MCI	7	3.2	IL	VAN	REAR	YES	YES	(16)
9/19/80	LAWRENCE	JOHNSON	MO-99	350.0	CI		2.4	IL	SEMI	FRONT R	YES	NO	(17)
9/19/80	LAWRENCE	JOHNSON	MIXED	20.2	CI		2.6		ST. TRUCK	MID LEFT	YES	YES	
9/19/80	LAWRENCE	JOHNSON	MO-99	16.6	CI	1	2.0	IL	AUTO	REAR CENT	YES	YES	
9/19/80	LAWRENCE	STYGAR	I,MO&P	106.6	CI	1	132.3		ST. TRUCK	ALL	YES	YES	(18)
9/19/80	OLD MANHEIM	POMYKALA	IR-192	46.3	CI	2	1.5	LA	VAN	MID MID	YES	YES	
9/19/80	OLD MANHEIM	MYERS	MO-99	527.0	UCI	2	.3	YO	ST. TRUCK	MID LEFT	YES	YES	
9/20/80	HIGN&MT PRS	JOHNSON	MIXED	114.8	CI	2	188.1		ST. TRUCK	ALL	YES	YES	(19)
9/20/80	LAWRENCE	FITCH	MIXED	5.6	CI	1	18.6	1	AUTO	MIDDLE	YES	NO	(20)

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DOT NON-COMPLIANCE ITEMS AND EXCEPTIONS (REFER TO PAGE 38)

1. Radiation level of 17 mR/hr at driver's seat. This was reduced to less than 2 mR/hr by shifting the packages to the rear of the vehicle.
2. The shipping papers had improper shipping name and quantity of each isotope, and lacked hazard class, Transport Index, or package label category. Radiopharmaceutical packages were not blocked or braced (e.g., when driver opened rear door, four boxes of labeled Yellow II and III's fell out of the rear onto the trooper).
3. Shipping papers were inaccessible (attached to box in rear of van and illegible). Total Transport Index for shipment was 57.2 which was in excess of the 50.0 limit for the type of radiopharmaceutical package present. (See pictures A in attachment.)
4. Shipping papers were not available for the industrial radiography gamma camera source. The radiography camera did not have any Yellow II labels on it, nor was the camera properly secured within the vehicle.
5. Proper shipping papers were not readily available. The carrier was stopped after just receiving radiopharmaceutical packages at one of the cargo terminals at O'Hare Airport.
6. Vehicle was not placarded while transporting Yellow III radiopharmaceutical packages. Packages were not blocked and braced. Labels (i.e., Yellow III) on empty boxes were not properly defaced. Driver marked the labels with a marking pen during the surveillance stop. (See picture B in attachment.)
7. Vehicle was not placarded.
8. Overpacks had mixtures of both Yellow II, White I and limited in the boxes. The shipping labels attached to the overpacks were not properly completed (i.e., total activity in curies, total TI, etc.).
9. Placards displayed on vehicle when only White I packages were being transported. This is not in violation with DOT regulations, but if continued and a vehicle accident would occur, responding personnel to the accident might overreact. Shipping papers did not identify the isotope nor the source activity in millicuries or curies.
10. Shipping papers did not properly list the name of the radionuclide nor the shipper or consignee. Vehicle was not placarded even though the radioactive material package had a Yellow III label. The package was surveyed with an ionization chamber survey instrument and at that time, a White I label was sufficient.
11. Vehicle was not placarded. Shipper's certification was not on shipping papers. Empty packages on the vehicle had Yellow III labels that were not defaced. (See picture C in attachment.)

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12. Radiopharmaceutical packages had Yellow III labels when the Transport Index listed on the label as well as the Transport Index determined by the trooper indicated the label should have been Yellow II.
13. Radionuclide was not listed on Yellow II label and labels were placed on only one side of the package.
14. Radioactive material package was not braced and blocked. (See picture D in attachment.)
15. Vehicle was not placarded when package had a Yellow III label. Package was overlabeled containing isotopes with a decay half life greater than one year, when Transport Index was determined by the trooper to be 0.4, requiring only a Yellow II label. Improper shipping name on the shipping papers. The papers were taped to the package, and thus not readily available.
16. Shipping papers were illegible and proper shipping name was not on package. Radiopharmaceuticals were not in a specification container. (See pictures F in attachment.)
17. Vehicle was not placarded. Package was not braced and blocked. Both rear doors on the vehicle open with the package on a skid. (See pictures G in attachment.)
18. The total Transport Index for the vehicle was 132.3, exceeding a total TI of 50 for the type of packages present. Packages were overlabeled when Transport Index on the Yellow III label was stated to be 0.9 and the trooper determined it to be 0.5, requiring only a Yellow II label.
19. Vehicle was not placarded. The radiation levels at the driver's seat were 10.0 mR/hr; after shifting the packages, the level was lowered to less than 2 mR/hr.
20. The total Transport Index was 188.1, exceeding a total TI of 50 for the type of radiopharmaceutical packages present.

Package inspections occurred during the surveillance stops where one or two packages were surveyed. All packages could not be surveyed since the number of packages on board a vehicle varied between one and 203 which would have taken a considerable amount of time and would cause shipments to miss airline flights. The following information was obtained from the survey forms completed by the troopers.

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<u>PACKAGE TYPE</u>	<u>SURFACE mR/hr</u>	<u>3' mR/hr</u>	<u>TI LABEL</u>	<u>ISOTOPE</u>	<u>QUANTITY</u>	<u>SHIPPING LABEL</u>
A	10.0	0.5	0.8	Ra-226	4.5mCi	II
A	10.0	0.5	0.5	Ra-226	4.5mCi	II
A	10	0.5	1.0	Ra-226	4.5mCi	II
A	5.0	0.3	0.4	I-131	1.4mCi	II
A	15.0	none	0.3	I-131	6.0mCi	II
A	4	0.3	0.4	I-123	80.0mCi	II
A	30.0	0.5	0.9	Ir-192	95.0Ci	II
A	0.8	none	0.1	Mo-99	0.3mCi	II
A	1.5	0.1	1.1	Mixed	71.3mCi	II
				Overpack		
A	23.0	1.9	2.9	Mo-99	2.8Ci	III
A	19.0	1.0	2.2	Mo-99	2.2Ci	III
A	18.0	1.3	2.0	Mo-99	10.8Ci	III
A	20.0	2.0	2.0	Mo-99	16.6Ci	III
A	30.0	2.0	2.9	Mo-99	2.7Ci	III
A	48.0	2.5	2.8	Mo-99	2.5Ci	III
A	20.0	1.1	1.2	Mo-99	1.0Ci	III
A	20	1.0	1.2	Ga-67	85.5mCi	III
A	19	1.3	3.0	Ga-67	258.0mCi	III
A	35.0	0.5	0.4	I-131	10.0mCi	III
A	15.0	0.5	0.9	P-32	34.0mCi	III
A	22	1.0	1.0	Tl-201	156.0mCi	III
A	10.5	0.3	0.8	Mixed	106.8mCi	III
				Overpack		
A	1.7	0.5	0.7	Mixed	10.3mCi	III
				Overpack		
A	3.8	0.4	◀10.0	Mixed	0.3mCi	III
				Overpack		
B	24.0	2.6	3.4	Mo-99	350.0Ci	III
Unknown	1.4	0.1	1.7	I-125	180.0mCi	III
Unknown	1.5	0.1	1.0	I-125	160.0mCi	III
Unknown	6.0	0.5	0.5	Hg-203	8.0mCi	III

The following observations were noted from this special project in the O'Hare Airport area. Manpower availability should be increased if and when a concentrated surveillance study reoccurs at O'Hare Airport. There should be at least five troopers per shift allowing coverage of both the east and west bound traffic along the Kennedy Expressway at O'Hare. At least ten vehicle surveillance stops were missed due to traffic congestion. The change of shifts resulted in the troopers not paying attention to their alarming rate meters, and assuming the vehicle had already been stopped by another trooper. Also, there was a shortage of working instruments during the last days.

One pursuit occurred at Old Higgins and Mt. Prospect Road where a cargo train (e.g., small tractor pulling carts loaded with baggage) left the cargo terminal and entered the airport property with a Mo-99 generator (confirmed by the cargo terminal manager). The cart was not placarded, and a representative from the Department of Nuclear Safety attempted to make a surveillance stop, but lost the cargo train within the airport property.

Another instance involved a trooper performing a surveillance stop inspection when two vehicles transporting radioactive material pulled up, noticed the trooper's vehicle, then disappeared within the cargo terminal areas at O'Hare. Also, several shipments were probably missed due to the Transport Index either being low or the isotope energy level being too low to be detected by the SPA-3 probe. One carrier driver during an inspection indicated three previous shipments that day were missed.

The following recommendations are being made to improve the effectiveness of the transportation study. One, periodically, ten-man teams of troopers from the Chicago area should perform a two-day study at the O'Hare Airport area between 8:00 a.m. and midnight since 80% of the stops occurred in that time frame. This will determine if the carriers are attempting to comply with the regulations. Also, the carriers will realize the state is concerned about transportation of radioactive materials. There were be five troopers per eight hour shift with the rover and relief trooper stationed at Mt. Prospect and Old Higgins Road whenever possible. Two, cargo terminal managers should be contacted to determine the time period and days in which large quantities of radioactive material packages will be present. Also, the sotrage areas should be surveyed since at least one terminal had Yellow III packages placed on top of a desk where two individuals were working. The radiation levels were 8-12 mR/hr at the work area.

In summary, this surveillance study appears to be very beneficial in verifying the assumption made in the last three annual reports that less than one percent of all shipments traversing the State of Illinois were being surveyed. Concentration should be on radiopharmaceutical shipments, since 22% of all stops had serious violations present (i.e., driver's radiation level in excess of 2 mR/hr, vehicle not placarded, loads not properly braced and blocked, etc.). However, only 40% of all stops conducted resulted in "Notices of Apparent Violation" (NAV) being issued, which were generally for incorrect shipping papers and labels on packages.

Information received as a result of this study provides baseline data regarding transportation of radioactive materials within the state. It is suggested that another O'Hare Airport study for seven days be conducted around May, 1981, and that the recommendations outlined above be implemented. This should result in a significant increase in the amount of documented information available for future analysis and evaluation.

APPENDIX B

SHIPPER'S CERTIFICATION FOR RADIOACTIVE MATERIALS
Two complete and signed copies of this certification shall be furnished to the carrier.

WARNING: Failure to comply in all respects with the applicable requirements of the Department of Transportation, 49 CFR, Part 171, for international shipments, the IATA Restricted Articles Manual, or any other applicable regulation, may be a breach of the applicable law, subject to legal penalties. This certification shall be so prepared and signed by an IATA Cargo Agent or a shipper/consignor for international shipments.

This shipment is within the limitations provided for **limited use passenger aircraft** **restricted use passenger aircraft** **restricted use cargo aircraft** **limited use cargo aircraft** **restricted use cargo aircraft** **limited use cargo aircraft** **restricted use cargo aircraft**

NATURE AND QUANTITY OF CONTENT						PACKAGING			
UNIFORM REPORTING NUMBER	DESCRIPTION	GROUP	FORM	ACTIVITY	NET WEIGHT (KG)	NET VOLUME (L)	TYPE OF CONTAINER	TYPE OF LABEL	DATE OF LABELING
		VI	(K)	1.1	1	II			A
		VI	(K)	1.1	1	II			A
		VI	(K)	1.1	1	II			A

ADDITIONAL INFORMATION REQUIRED FOR FISSILE MATERIALS ONLY

EXEMPTED FROM THE ADDITIONAL REQUIREMENTS FOR FISSILE MATERIALS SPECIFIED IN 1. OF PART 171 OF THE IATA RESTRICTED ARTICLES REGULATIONS:

NAMES, PLUS QUANTITY IN GRAMS, OR CONCENTRATION OR ENRICHMENT IN LITRE

NO: EXEMPTED: FISSILE CLASS I FISSILE CLASS II FISSILE CLASS III

Additional certificates obtained by the Shipper when necessary:

Special Form Encapsulation Certificate: Certificate for Large Radioactive Source
 Type "B" Packaging Certificate: Government Approval - Packing
 Certificate for Fissile Material:

Special Handling Information: For radioactive materials in limited use of cargo aircraft only, refer to 171.107(b)

I hereby certify that the contents of this consignment are fully and accurately described above by Proper Shipping Name and are classified, packed, marked, labeled and in proper condition for carriage by air according to applicable national governmental regulations, and for international shipments, the current IATA Restricted Articles Regulations.

Name and full address of Shipper:

Name and title of person signing Certification:

Date:

(A)

Isotope name not legible and transport group for Xe-133 is III, not VI. for a compressed gas.

UNIFORM STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPPER'S COPY TO BE DESTROYED

DATE OF ISSUE:

DATE OF RECEIPT:

DATE OF DELIVERY:

SHIPPER'S NAME:

ADDRESSES:

CONSIGNEE'S NAME:

ADDRESSES:

TERMS: NET 30 DAYS FROM DATE OF INVOICE

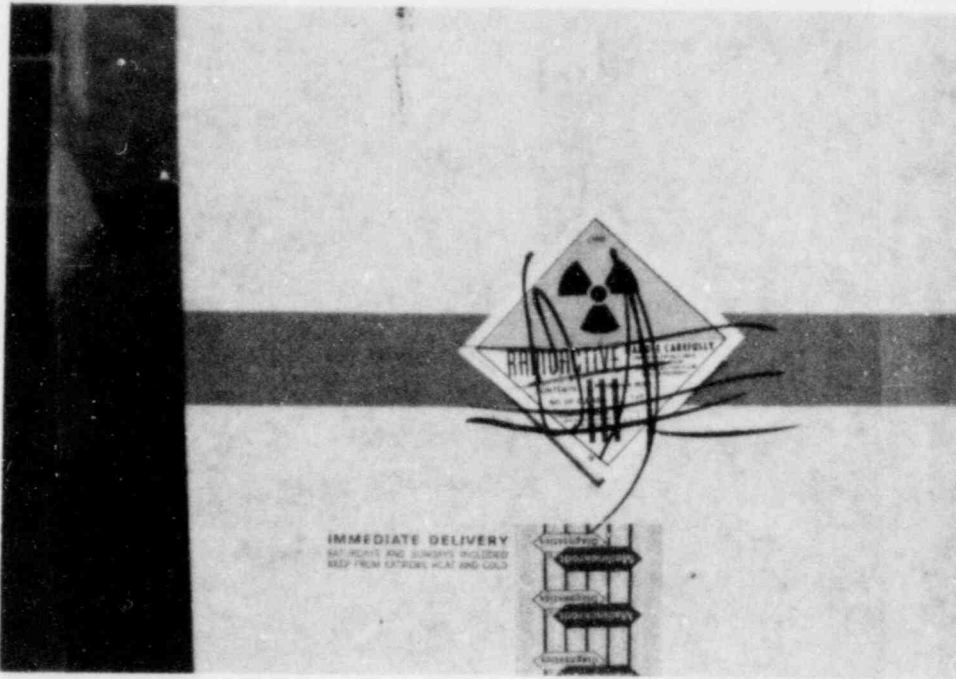
TYPE OF PACKAGING:

QUANTITY	UNIT	DESCRIPTION	MARKS AND NUMBERS	WEIGHT OR MEASURE	DATE OF ISSUE	DATE OF RECEIPT	DATE OF DELIVERY

This B/L is valid only when the above-mentioned conditions are complied with. It is subject to the applicable regulations of the Department of Transportation.

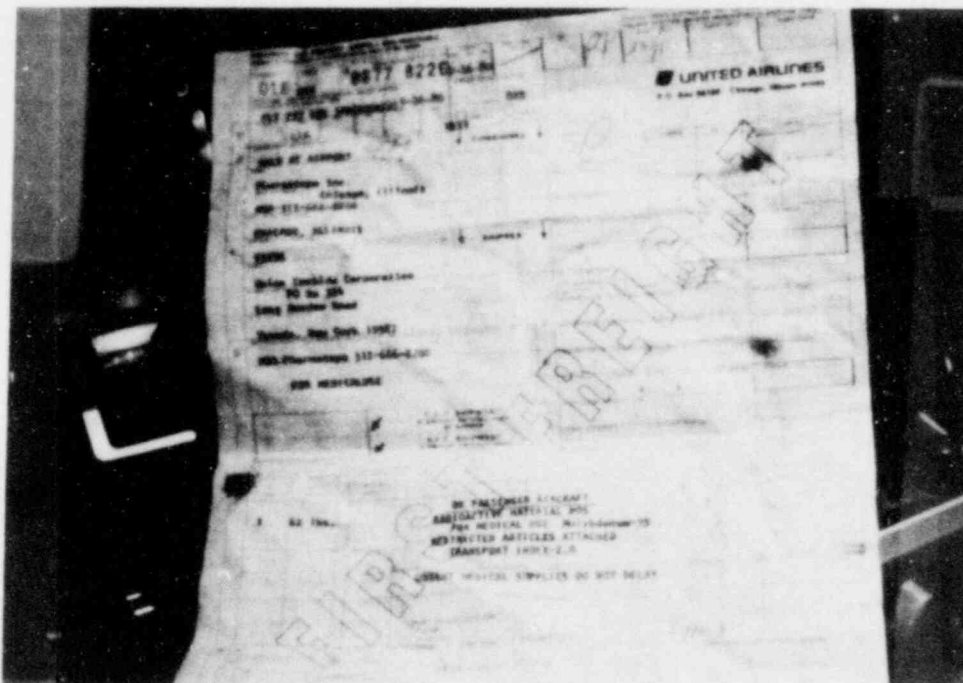
(A) TI total was 57.2, not 50.

APPENDIX B

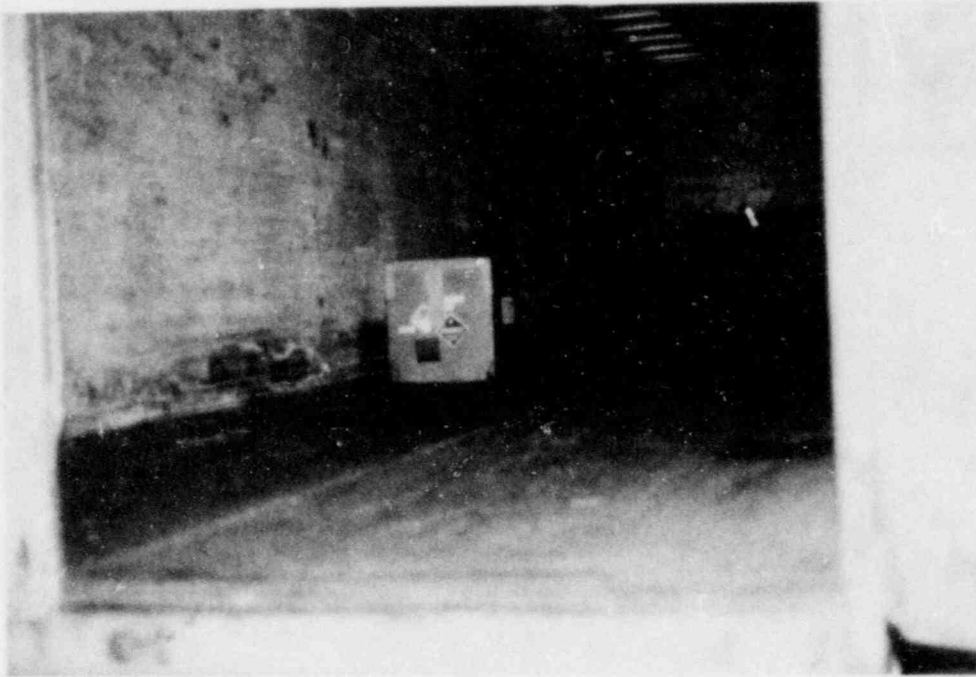


(B) Empty box where label was not defaced.

(C) No shippers certification on shipping paper.



APPENDIX B

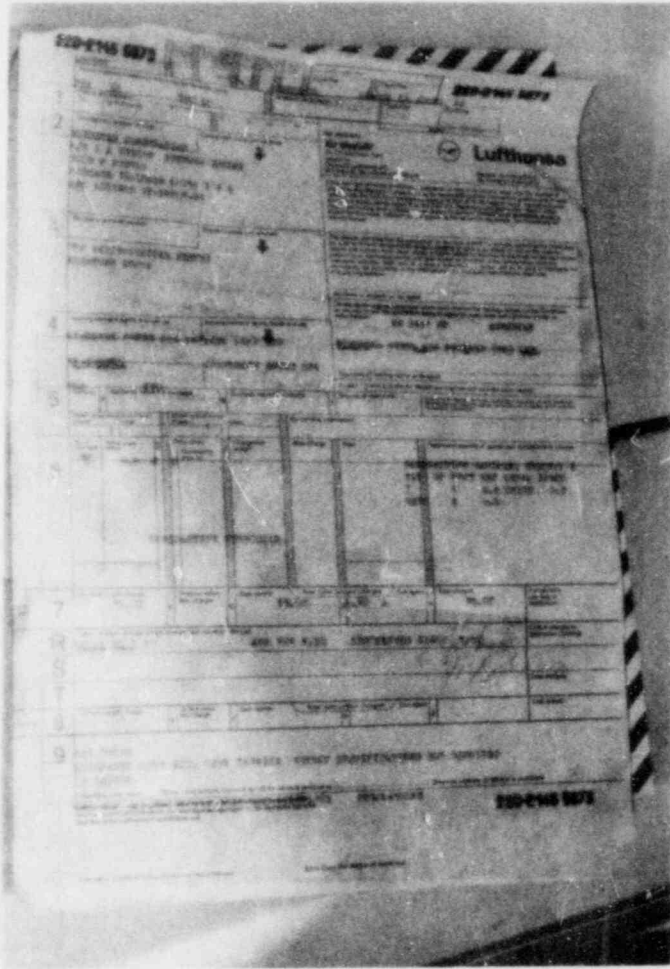


(D) Failure to brace and block the package.

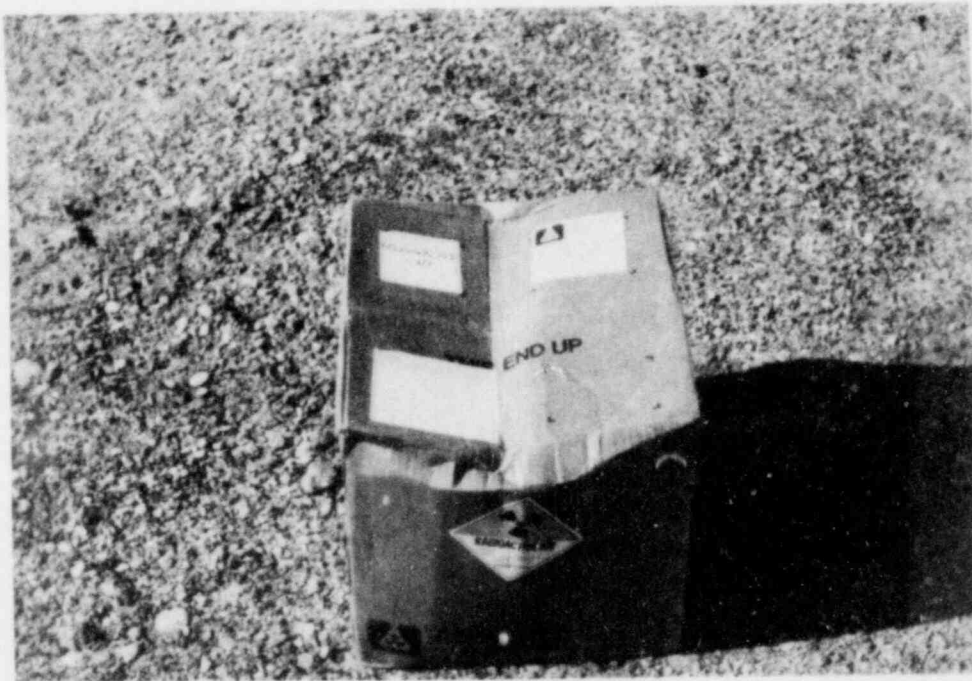
(E) Shipping label TI was 0.4 and shipping papers attached to package.



APPENDIX B

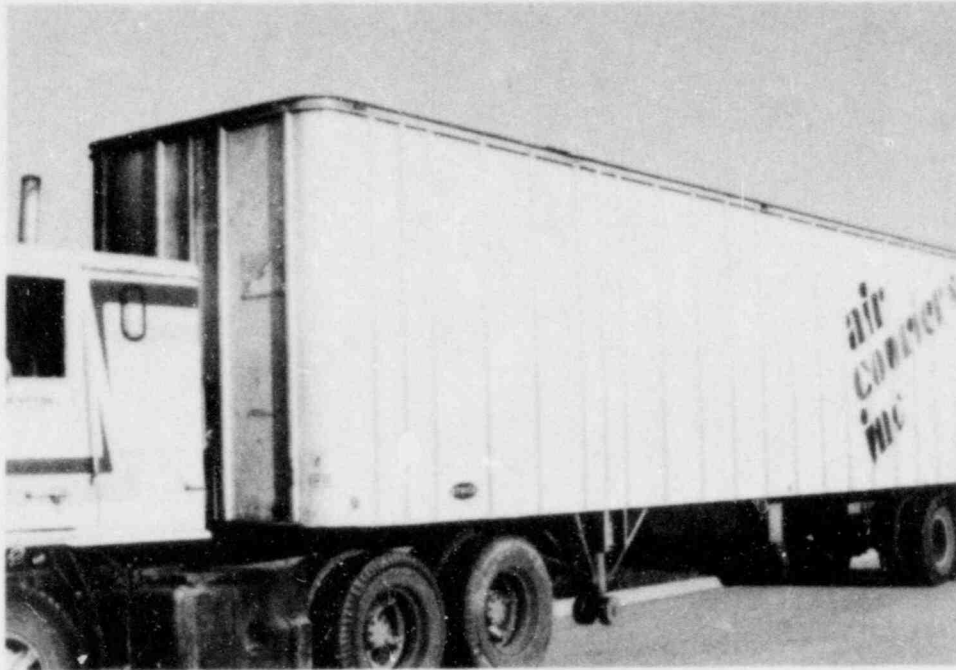


(F) Shipping papers illegible.



(F) Radioactive material not in specification container.

APPENDIX B



(G) Vehicle not placarded with 350.0 Ci of Molybdenum-99 on board.

(G) Both rear doors open on vehicle and package not braced and blocked while in transit.



APPENDIX C
INSPECTION DATA SHEET

APPENDIX C

DIVISION OF STATE POLICE
HAZARDOUS MATERIALS
SECTION

RADIOACTIVE MATERIALS
VEHICLE INSPECTION
DATA SHEET

Office Use Only:
District _____
Year & Sequential Number: _____

I. VEHICLE INFORMATION

Location _____ Mile Post _____ County Code No. _____
 Date _____ Time _____ License No. _____ Year _____ State _____
 Vehicle Type _____ (1. Passenger Car 2. Pick-up 3. Van 4. Straight Truck 5. Semi 6. Double Bottom 7. Other _____)
 Carrier Type _____ (1. Common 2. Contract 3. Private) Properly Placarded _____ Yes _____ No
 Carrier Name _____
 Carrier Address _____
 Drivers Name _____ Drivers Lic. No. & State _____

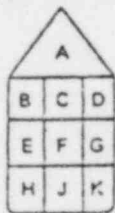
II. SHIPPING DOCUMENTS

Shipping Papers _____ Yes _____ No Shipping Name _____
 Hazard Class _____ Isotope _____
 Total Quantity _____ (1. Curies (Ci) 2. Millicuries (m Ci) 3. Microcuries (u Ci) 4. Pounds 5. Kilograms)
 Package Type _____ (1. A 2. B 3. Other _____)
 Special Form _____ Yes _____ No Normal Form _____ (1. Gas 2. Liquid 3. Solid or Powder)
 Transport Index (Total for Vehicle) _____
 Labels _____ (1. No Label Required 2. White I 3. Yellow II 4. Yellow III 5. Other _____)
 Fissile Class _____ (1. Fissile I 2. Fissile II 3. Fissile III 4. Fissile Exempt)
 Exclusive Use _____ Yes _____ No Exclusive Use Instructions With Vehicle _____ Yes _____ No
 Shipper Name _____
 Shipper Address _____
 Consignee Name _____
 Consignee Address _____

III. VEHICLE SURVEY

Radiation Levels _____ MR/HR Cab Seat Exclusive Use
Limit is 2 mR/hr
(Private Carrier Exempt) _____ MR/HR Outside Surface (Highest Reading)
 _____ MR/HR Six Feet From Outside Surface (Exclusive Use Only)

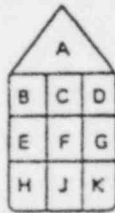
Package Placement (1. Passenger Car 2. Pick-up 3. Van 4. Straight Truck 5. Semi 6. Double Bottom 7. Other _____)



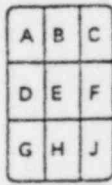
1.



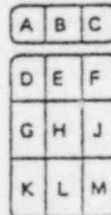
2.



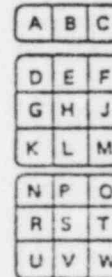
3.



4.



5.



6.

Package Separation _____ Feet From Occupied Area.

Office Use Only

District _____ Year & Sequential Number _____

IV. OTHER HAZARDOUS MATERIALS ON VEHICLE Yes No

Shipping Name _____

Hazard Class _____ Quantity _____

V. SURVEY RESULTS No Irregularities Detected

Enforcement Action Yes No NAV issued Yes _____ Number No

5800.1 Yes No Illinois Department of Nuclear Safety Notified Yes No

VI. PACKAGE INFORMATION - OPTIONAL DATA

To be obtained when obvious discrepancies are present i.e., radiation readings in excess of regulatory limits, indication of radioactive material on board and shipping papers are missing or show no radioactive material and where shipping papers do not provide required information and such information is essential to proper enforcement action.

Pack No.	Pack Type	Pack Spec. No.	Pack Seal	Label	Isotope	Quantity	Transport Group	Surface Reading	T. I. Label	T. I. Inst. Reading	Gross Weight
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											

Total Packages in Shipment _____ Number of Packages Inspected _____

Removable Contamination Yes No

Package Labeled for Additional Hazard Yes No

L.S.A. Packages Marked or Stenciled (Radioactive - LSA) Yes No

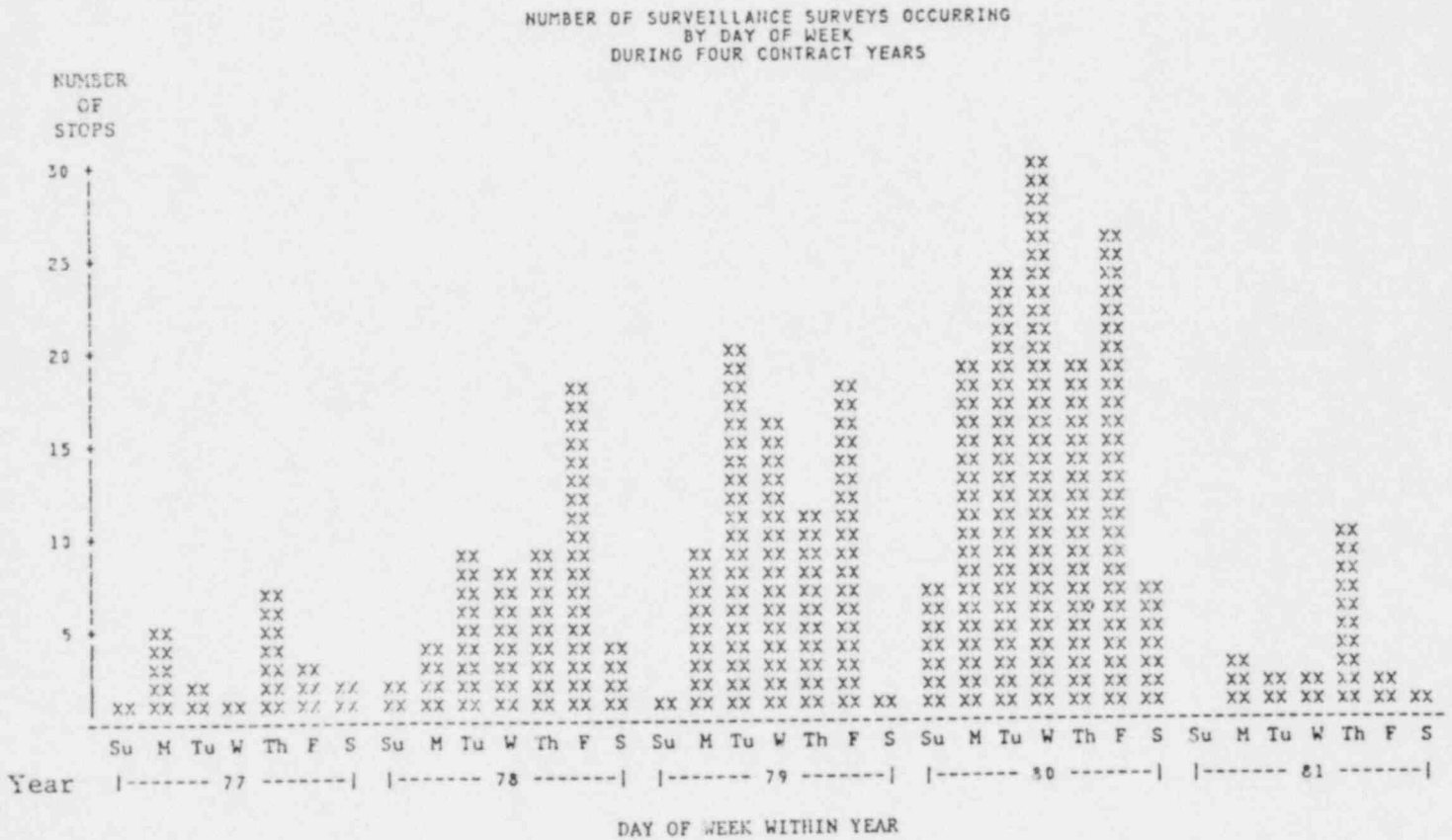
Name _____ Rank _____ ID _____ District _____

APPENDIX D

DATA BY HOUR, DAY, MONTH

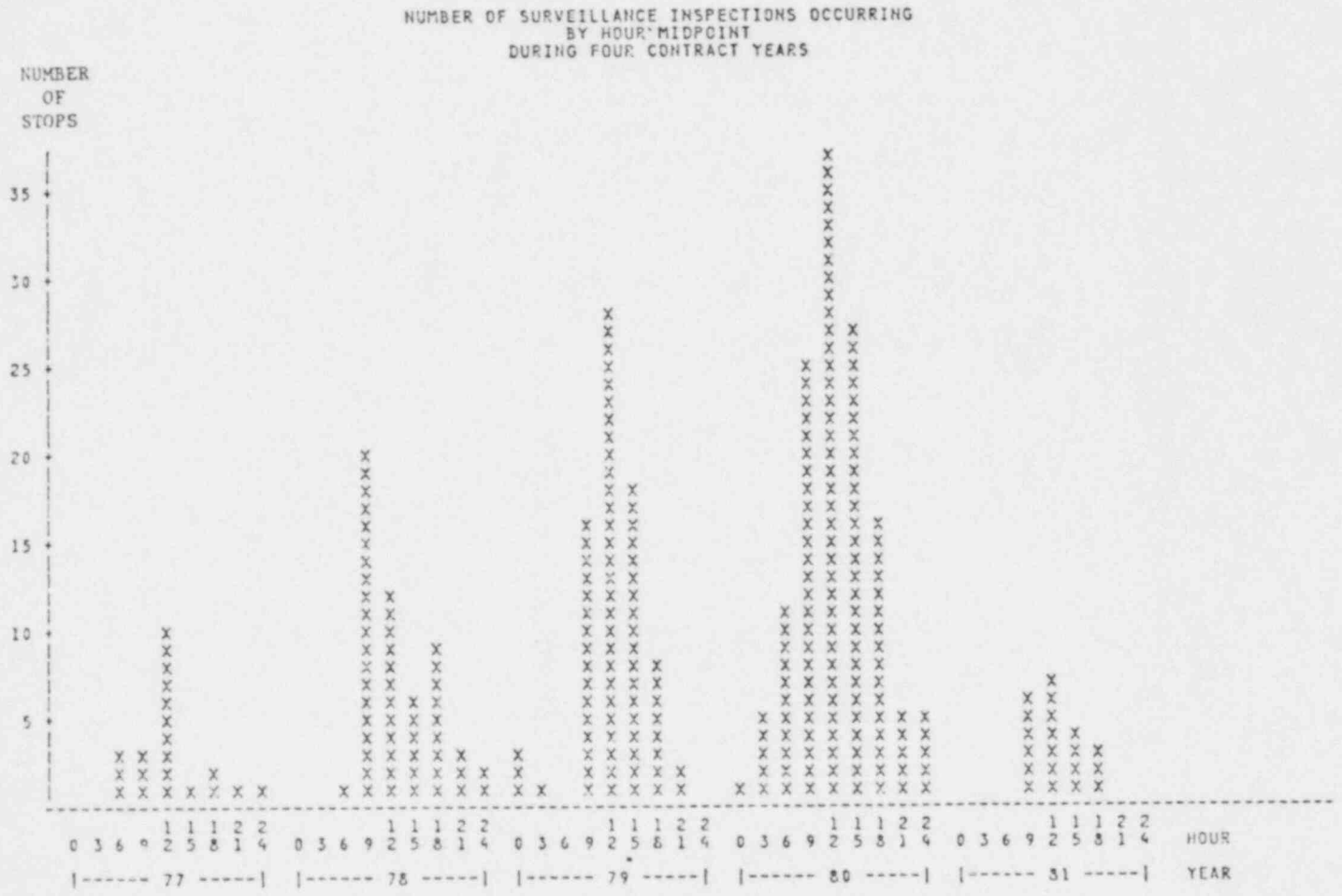
APPENDIX D

The following chart indicates the number of surveillance stops by day of week during the last 5 years, June 6, 1977 - June 1, 1981. The most active day appears to be Friday due to radiopharmaceutical shipments to hospitals, replenishing their supplies for the beginning of the week.



APPENDIX D

The following chart depicts the hour midpoint by 3 hour intervals in which surveillance stops occurred during the last 4 contract years. The contract years are broken down into 5 periods, where 1977 and 1981 only show the time interval for material movement covering 6 months.



APPENDIX D

The following table indicates the surveillance activity occurring per month during the last four contract years. The total activity for the month of September is misleading since the O'Hare study accounted for the 50 of the 73 stops.

NUMBER OF SURVEILLANCE SURVEYS
BY MONTH
DURING FOUR CONTRACT YEARS

MONTH	YEAR					TOTAL
	77	78	79	80	81	
	FREQUENCY					
	PERCENT					
	ROW PCT					
	COL PCT					
JAN	0 0.00 0.00 0.00	4 1.32 22.22 7.41	3 0.99 16.67 3.95	6 1.98 33.33 4.55	5 1.65 27.78 25.00	18 5.94%
FEB	0 0.00 0.00 0.00	5 1.65 31.25 9.21	3 0.99 18.75 3.95	4 1.32 25.00 3.03	4 1.32 25.00 20.00	16 5.28%
MAR	0 0.00 0.00 0.00	6 1.98 19.35 11.11	7 2.31 22.58 9.21	9 2.97 29.03 6.82	9 2.97 29.03 45.00	31 10.23%
APR	0 0.00 0.00 0.00	3 0.99 21.43 5.56	3 0.99 21.43 3.95	6 1.98 42.86 4.55	2 0.66 14.29 10.00	14 4.62%
MAY	0 0.00 0.00 0.00	9 2.97 37.50 16.67	7 2.31 29.17 9.21	8 2.64 33.33 6.06	0 0.00 0.00 0.00	24 7.92%
JUNE	5 1.65 18.52 23.81	4 1.32 14.81 7.41	10 3.30 37.04 13.16	8 2.64 29.63 6.06	0 0.00 0.00 0.00	27 8.91%
JULY	2 0.66 13.33 9.52	4 1.32 26.67 7.41	4 1.32 26.67 5.26	5 1.65 33.33 3.79	0 0.00 0.00 0.00	15 4.95%
AUG	2 0.66 8.00 9.52	6 1.98 24.00 11.11	9 2.97 36.00 11.84	8 2.64 32.00 6.06	0 0.00 0.00 0.00	25 8.25%
SEPT	2 0.66 2.74 9.52	4 1.32 5.48 7.41	9 2.97 12.33 11.84	58 19.14 79.45 43.94	0 0.00 0.00 0.00	73 24.09%
OCT	3 0.99 15.00 14.29	6 1.98 30.00 11.11	6 1.98 30.00 7.89	5 1.65 25.00 3.79	0 0.00 0.00 0.00	20 6.60%
NOV	0 0.00 0.00 0.00	2 0.66 13.33 3.70	6 1.98 40.00 7.89	7 2.31 46.67 5.30	0 0.00 0.00 0.00	15 4.95%
DEC	7 2.31 25.00 33.33	1 0.33 4.00 1.85	9 2.97 36.00 11.84	8 2.64 32.00 6.06	0 0.00 0.00 0.00	25 8.25%
TOTAL	21 6.93	54 17.82	76 25.08	132 43.56	20 6.60	303 100.00%

APPENDIX E
PACKAGE DATA

THE FOLLOWING CHART INDICATES THE TOTAL NUMBER OF RADIOACTIVE MATERIAL PACKAGES PRESENT PER SURVEILLANCE BY CARRIER TYPE DURING THE LAST 5 YEARS. IN ILLINOIS, COMMON CARRIERS TRANSPORTED MORE PACKAGES THAN CONTRACT AND PRIVATE CARRIERS COMBINED.

APPENDIX E

TOTAL PACKAGES OF RADIOACTIVE MATERIAL
BY CARRIER TYPE
DURING FOUR CONTRACT YEARS

YEAR	CARRIER TYPE	TOTAL STOPS	TOTAL PACKAGES
77	COMMON	5	211,000
	CONTRACT	7	151,000
	PRIVATE	8	36,000
	COMMON	20	813,000
78	CONTRACT	10	123,000
	PRIVATE	24	94,000
	COMMON	25	418,000
	CONTRACT	30	862,000
79	PRIVATE	11	17,000
	COMMON	74	1832,000
	CONTRACT	30	1222,000
	PRIVATE	25	77,000
80	COMMON	12	115,000
	CONTRACT	5	44,000
	PRIVATE	4	4,000
	CONTRACT	4	4,000

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APPENDIX E

The following table depicts the physical form of the radioactive material in the shipments surveyed during the last five years.

PHYSICAL FORM OF THE RADIOACTIVE MATERIAL SHIPMENTS
BY YEAR
DURING FOUR CONTRACT YEARS

		YEAR					TOTAL
		77	78	79	80	81	
PHYSICAL FORM	FREQUENCY						
	PERCENT ROW PCT COL PCT						
		1	0	3	0	0	*
		
		
Gas		0	0	0	1	1	2
		0.00	0.00	0.00	0.33	0.33	0.67
		0.00	0.00	0.00	50.00	50.00	
		0.00	0.00	0.00	0.76	5.00	
Liquid		3	3	6	23	0	35
		1.00	1.00	2.01	7.69	0.00	11.71
		8.57	8.57	17.14	65.71	0.00	
		15.00	5.56	8.22	17.42	0.00	
Solid		14	51	65	82	17	229
		4.68	17.06	21.74	27.24	5.69	76.59
		6.14	22.37	28.51	35.81	7.46	
		70.00	94.44	89.04	2.12	85.00	
Mixture		3	0	2	26	2	33
		1.00	0.00	0.67	8.69	0.67	11.03
		9.68	0.00	6.45	78.78	6.45	
		15.00	0.00	2.74	19.69	10.00	
TOTAL		20	54	73	132	20	299
		6.69	18.06	24.41	44.15	6.69	100.00

*Four stops, one in '77 and three in '79, involved individuals treated with radioactive iodine.

APPENDIX E

The following table indicates the total number of packages on the vehicles at the time of the survey during the last four contract years. Most of the single package stops were either industrial radiographers or construction personnel with moisture-density gauges.

TOTAL NUMBER OF RADIOACTIVE MATERIAL PACKAGES PRESENT
BY SURVEILLANCE SURVEY INSPECTION
DURING FOUR CONTRACT YEARS

Total Packages	No. of Stops	Total Packages	No. of Stops	Total Packages	No. of Stops
FREQUENCY PERCENT ROW PCT COL PCT	0	FREQUENCY PERCENT ROW PCT COL PCT	0	FREQUENCY PERCENT ROW PCT COL PCT	0
*	14	8	4	18	1
	.		1.38		0.35
	.		100.00		100.00
	.		1.38		0.35
1	119	9	4	19	3
	41.18		1.38		1.04
	100.00		100.00		100.00
	41.18		1.38		1.04
2	21	10	8	20	4
	7.27		2.77		1.38
	100.00		100.00		100.00
	7.27		2.77		1.38
3	5	11	1	23	3
	1.73		0.35		1.04
	100.00		100.00		100.00
	1.73		0.35		1.04
4	4	12	3	25	5
	1.38		1.04		1.73
	100.00		100.00		100.00
	1.38		1.04		1.73
5	6	15	3	26	2
	2.08		1.04		0.69
	100.00		100.00		100.00
	2.08		1.04		0.69
6	5	16	1	27	1
	1.73		0.35		0.35
	100.00		100.00		100.00
	1.73		0.35		0.35
7	5	17	2	30	4
	1.73		0.69		1.38
	100.00		100.00		100.00
	1.73		0.69		1.33
TOTAL	289	TOTAL	289	TOTAL	289
	100.00		100.00		100.00

*Trooper was unable to determine the total number of packages present due to insufficient properly prepared shipping papers or other priorities (i.e. accident, etc.) developed during the inspection.

APPENDIX E

TOTAL NUMBER OF RADIOACTIVE MATERIAL PACKAGES PRESENT BY SURVEILLANCE SURVEY INSPECTION DURING FOUR CONTRACT YEARS

Total Packages	No. of Stops	Total Packages	No. of Stops	Total Packages	No. of Stops
FREQUENCY PERCENT ROW PCT COL PCT	0	FREQUENCY PERCENT ROW PCT COL PCT	0	FREQUENCY PERCENT ROW PCT COL PCT	0
31	1 0.35 100.00 0.35	44	3 1.04 100.00 1.04	60	1 0.35 100.00 0.35
32	1 0.35 100.00 0.35	45	2 0.69 100.00 0.69	63	1 0.35 100.00 0.35
34	1 0.35 100.00 0.35	48	8 2.77 100.00 2.77	64	3 1.04 100.00 1.04
35	1 0.35 100.00 0.35	49	2 0.69 100.00 0.69	65	3 1.04 100.00 1.04
36	1 0.35 100.00 0.35	50	15 5.19 100.00 5.19	66	1 0.35 100.00 0.35
39	1 0.35 100.00 0.35	53	1 0.35 100.00 0.35	70	2 0.69 100.00 0.69
40	6 2.08 100.00 2.03	54	2 0.69 100.00 0.69	72	4 1.38 100.00 1.38
43	3 1.04 100.00 1.04	58	1 0.35 100.00 0.35	86	1 0.35 100.00 0.35
TOTAL	289 100.00	TOTAL	239 100.00	TOTAL	289 100.00

APPENDIX E

TOTAL NUMBER OF RADIOACTIVE MATERIAL PACKAGES PRESENT BY SURVEILLANCE SURVEY INSPECTION DURING FOUR CONTRACT YEARS

Total Packages	No. of Stops	Total Packages	No. of Stops
FREQUENCY PERCENT ROW PCT COL PCT	0	FREQUENCY PERCENT ROW PCT COL PCT	0
88	1 0.35 100.00 0.35	197	1 0.35 100.00 0.35
103	1 0.35 100.00 0.35	203	1 0.35 100.00 0.35
126	1 0.35 100.00 0.35	TOTAL	289 100.00
155	1 0.35 100.00 0.35		
158	1 0.35 100.00 0.35		
160	1 0.35 100.00 0.35		
171	1 0.35 100.00 0.35		
193	1 0.35 100.00 0.35		
TOTAL	289 100.00		

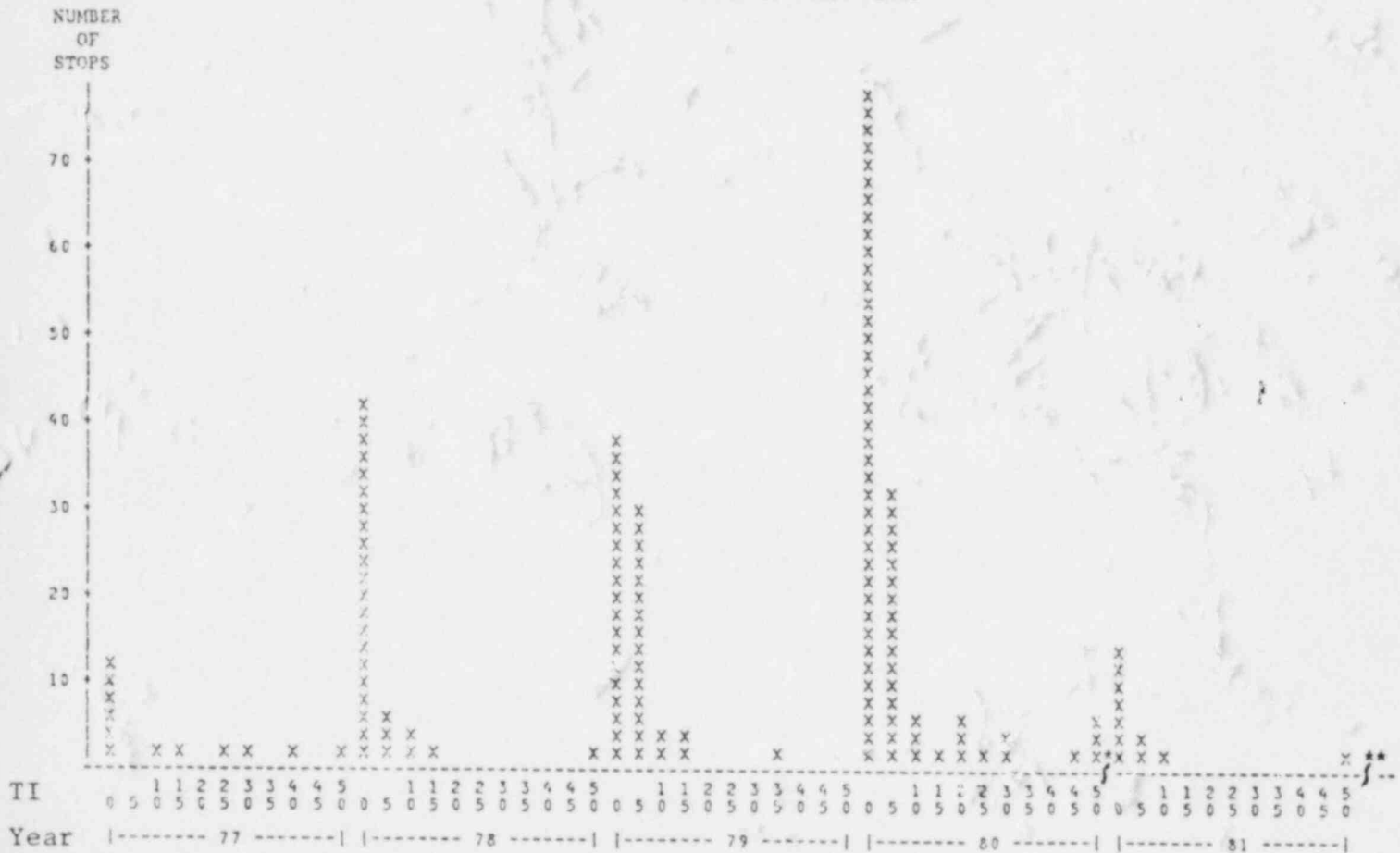
APPENDIX F

RADIATION LEVEL DATA

APPENDIX F

The following chart indicates the total Transport Index midpoint by increments of 5, present per shipment survey during the last 5 years.

TOTAL TRANSPORT INDEX OF SHIPMENTS
BY YEAR
DURING FOUR CONTRACT YEARS

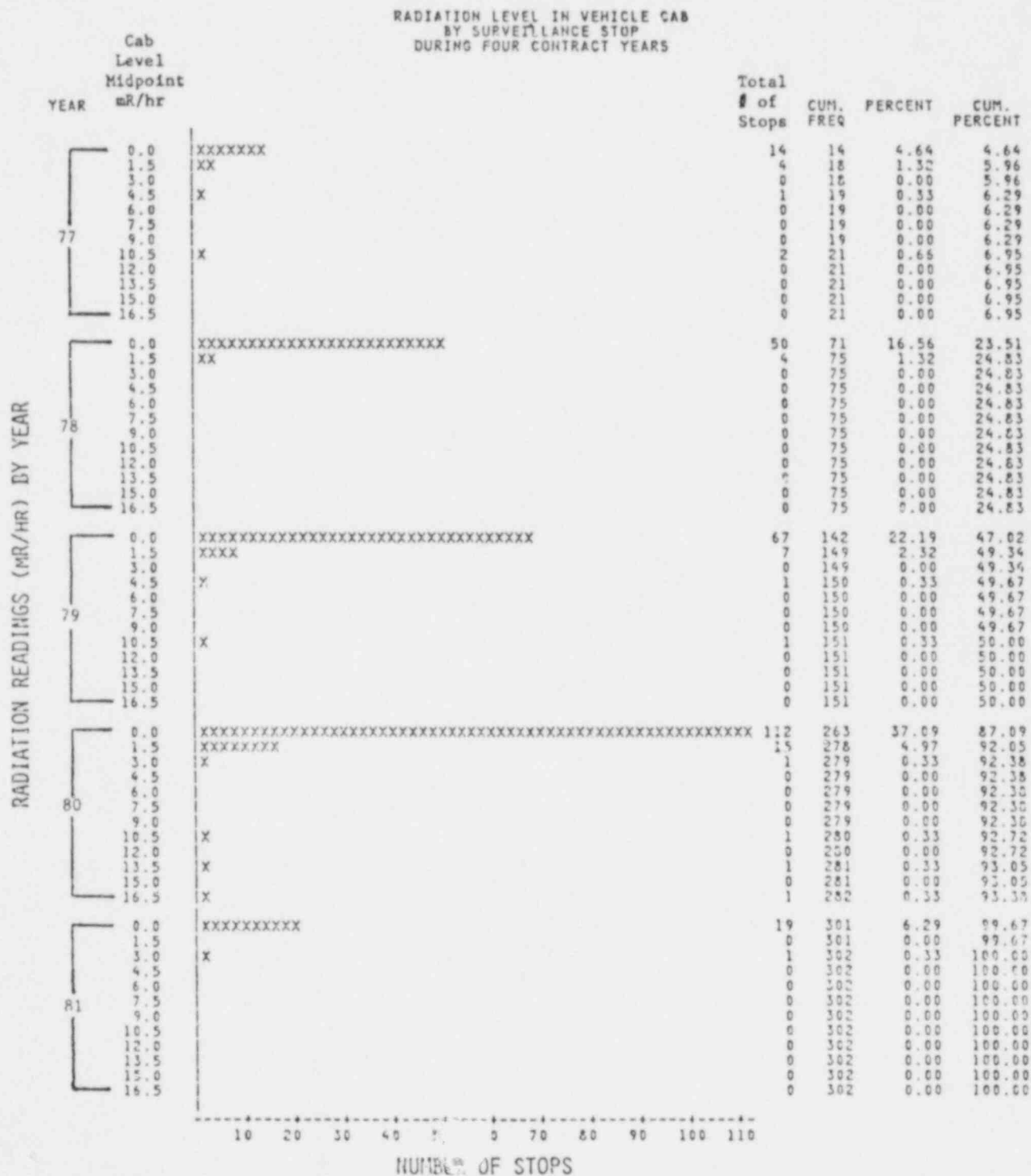


*TI Exceeded 50 5 times
**TI Exceeded 50 once

TOTAL T.I. BY YEAR

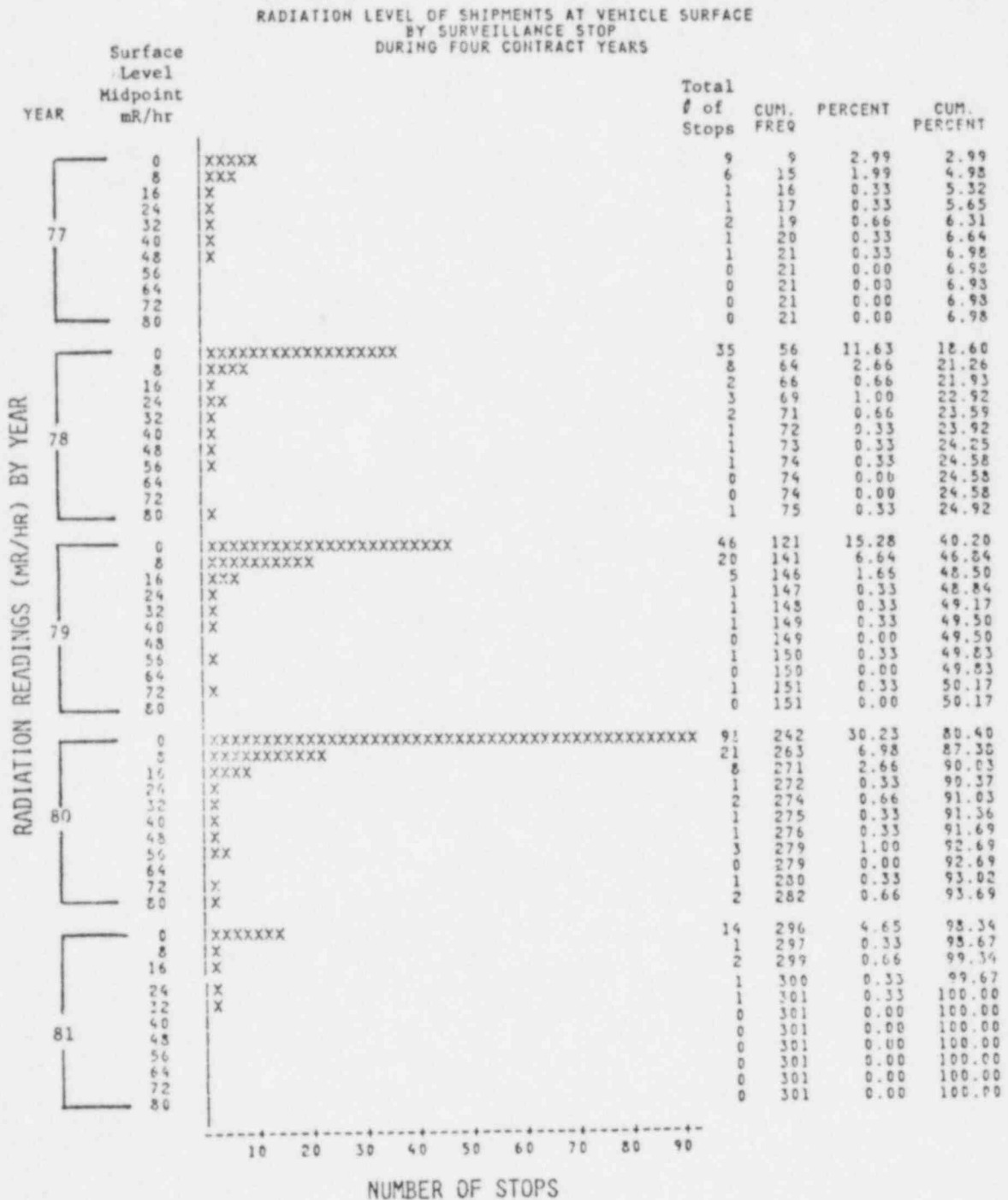
APPENDIX F

The following chart is of the highest cab level radiation reading for each stop. The radiation levels greater than 2.0 mR/hr were normally rectified by repositioning the packages in the vehicles, but in at least 3 instances, this was not possible since the total TI exceeded the 50 limit and the vehicle size was too restrictive.



APPENDIX F

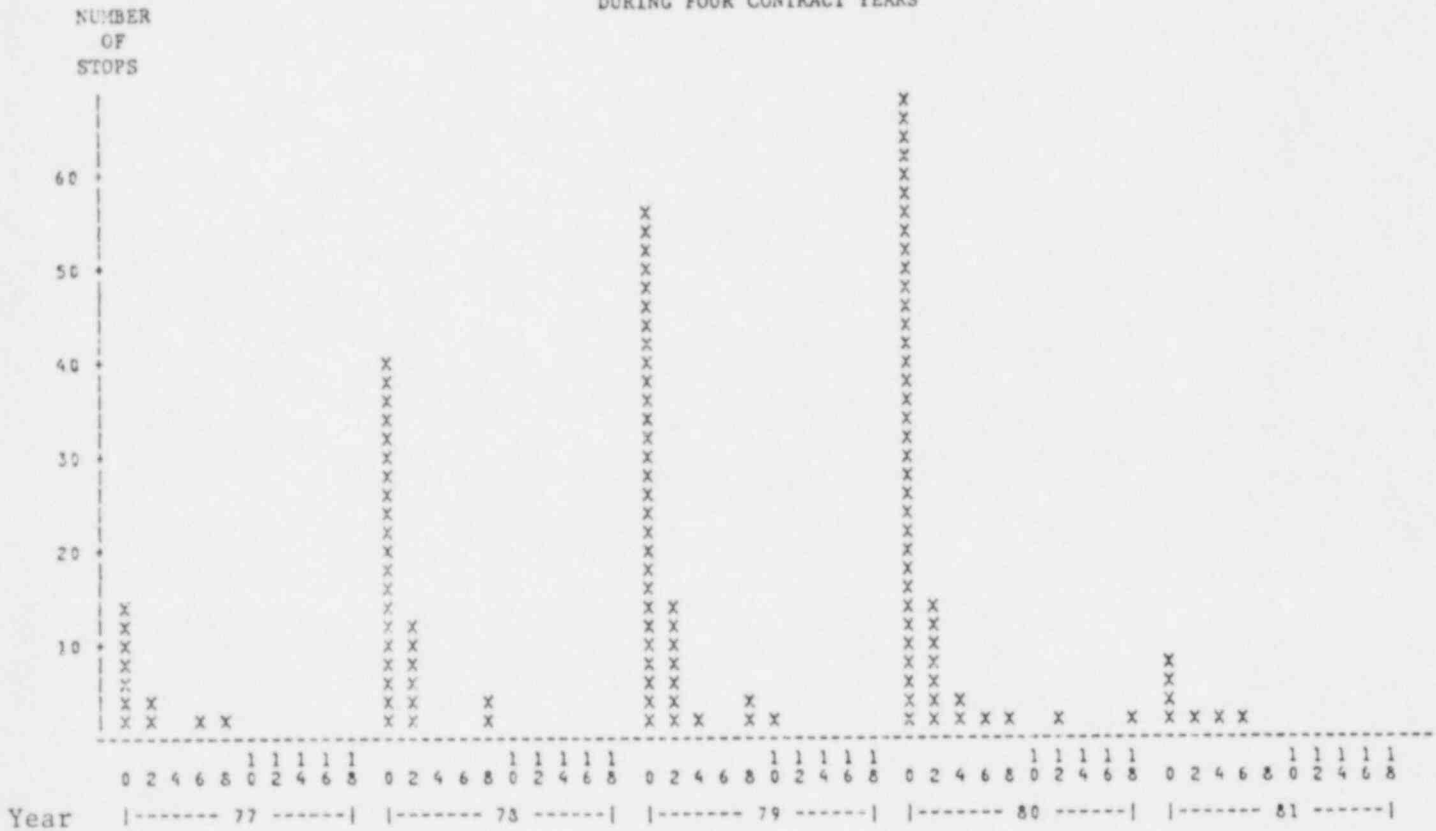
The following chart is of the highest vehicle surface radiation level for each stop. The radiation levels in excess of 48 mR/hr were for vehicles with a total TI greater than 50.



APPENDIX F

The following bar chart indicates the highest radiation reading at six feet from the vehicle. The number of background readings is misleading since the six foot reading is only taken if the vehicle is operated as exclusive use.

RADIATION LEVEL OF EXCLUSIVE USE VEHICLE SHIPMENTS AT SIX FEET
BY SURVEILLANCE STOPS
DURING FOUR CONTRACT YEARS



RADIATION READINGS (MR/HR) BY YEAR

APPENDIX G

CARRIER DATA

RADIOACTIVE MATERIAL SHIPMENTS
 BY CARRIER AND RADIATION LEVELS
 PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DATE	LOCATION	HOUR	CARRIER NAME	ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS	CAD LEVEL MR/HR	SURFACE LEVEL MR/HR	SIX FT LEVEL MR/HR	TOTAL TI
9/16/80	OLD MANHEIM	0115	AAA CARTAGE	RA-BE	4.5	MCI	IND	.0	.3	.0	1.0
9/18/80	OLD MANHEIM	1725	AIRBORN FRT	MIXED	14,349.0	UCI	MED	.1	.1	.0	.3
11/20/80	US20&I90	1240	AMF TUBSCOPE	IR-192	3.2	CI	IND	.0	.0	.0	2.0
9/03/80	I57	1005	ARK. BEST FRT	U NAT	11,180.0	MCI	LSA	.2	1.9	.4	5.8
9/03/80	I57	1159	ARK. BEST FRT	U NAT	41,605.0	LBS	LSA	.2	.9	.3	.0
11/10/80	EFINGHAM	0715	ASSOC. COUR	MO-99	725.0	MCI	MED	.1	.4	.4	2.2
9/19/80	LAWRENCE	0740	AIR COUR	MO-99	350.0	CI	MED	.1	10.5	.0	2.4
9/17/80	OLD MANHEIM	1804	AIRBORN FRT	MIXED	57.1	MCI	MED	.1	.3	.0	2.6
7/17/80	I57	1040	BAGGETT TRAN	U DEP	1,749.3	MCI	IND	.2	.5	.2	.4
3/19/81	IL121	0945	BASIN SURVEY	AM&BE	3.0	CI	IND	.1	.7	.0	.7
4/14/81	I-5 WB PLAZ	0853	BEST TRAN	UNK	200.0	UCI	LSA	.6	1.0	.1	1.3
9/18/80	OLD MANHEIM	1145	BIT INC.	MIXED	.4	MCI	LSA	.1	.2	.0	.4
8/13/80	US41&IL173	1020	C&H TRANS.	U-235	9,840.0	MCI	LSA	.0	.5	.0	9.0
1/31/81	IL 23	1616	CASPERSON	MIXED	27,210.0	MCI	MED	3.7	33.0	5.0	59.3
3/06/81	I55	0930	CASPERSON	MO-99	509.9	MCI	WAS-MED	.1	.4	.1	4.4
9/13/80	OLD MANHEIM	1400	CASPERSON	MIXED	19.0	CI	MED	17.0	31.0	.0	22.1
9/15/80	OLD MANHEIM	2320	CASPERSON	MIXED	592.0	MCI	MED	.3	13.0	.4	.0
9/15/80	OLD MANHEIM	1800	CASPERSON	MIXED	3,062.1	MCI	MED	.0	.0	.0	15.2
9/15/80	OLD MANHEIM	1715	CASPERSON	TL201	1,508.1	MCI	MED	.1	3.5	.0	1.2
9/16/80	OLD MANHEIM	2215	CASPERSON	MO99	5.5	CI	MED	2.0	6.0	.0	6.3
9/17/80	LAWRENCE	2220	CASPERSON	I31&TL	250.0	MCI	MED	.1	.5	.0	1.0
9/18/80	OLD MANHEIM	0855	CASPERSON	MO99	441.0	MCI	MED	.0	.1	.0	.2
9/19/80	LAWRENCE	1700	CASPERSON	I,MO&P	106.6	CI	MED	1.0	55.0	7.0	132.3
9/20/80	HIGH&MT PRS	0750	CASPERSON	MIXED	114.8	CI	MED	2.4	80.0	12.0	188.1
10/19/80	US51&IL71	0825	CASPERSON	MO&I31	2,606.0	MCI	MED	.3	9.0	.0	4.9
12/20/80	I55 NB	0206	CASPERSON	MIXED	112.7	CI	MED	1.4	70.0	18.0	189.8
12/26/80	I70 EB	1415	CASPERSON	I131MO	106.2	CI	MED	.5	18.0	9.0	106.2
9/26/80	IL90	0915	CENTURY GEO.	CS-137	125.0	MCI	IND	.1	.6	.0	.2
8/27/80	I74	0830	CHEM NUC		4,146.0	MCI	WASTE	.2	13.0	2.0	.0
9/03/80	I74	1220	CHEM NUC	MIXED	8,750.0	MCI	WASTE	.1	2.3	.4	.0
9/03/80	I74	1220	CHEM NUC	MIXED	8,750.0	MCI	WASTE	.1	2.3	.4	.0
1/05/81	I80 WB	1250	CONAM	IR-192	78.0	CI	IND	.3	.6	.0	1.5
6/13/80	I55	1300	CONSOL FRT.	CF-252	27.0	MCI	IND	.1	7.5	.4	5.0
9/20/80	LAWRENCE	0215	CONTRACT COUR	MIXED	5.6	CI	MED	.0	15.0	.0	18.6
11/30/80	IL26&AVON	1550	CONTRACT COUR	MIXED	15.0	CI	MED	11.0	44.0	5.0	50.0
12/23/80	US20&PEC RD	1445	CONTRACT COUR	MO99	55.4	CI	MED	14.0	50.0	4.0	45.1
3/12/81	I80 WB	1640	CROWN TRK	CO-60	.1	UCI	LSA	.0	.0	.0	.0
3/19/81	IL121	1235	DRESSER ATLAS	AM&BE	4.5	CI	IND	.1	.8	.1	3.0
11/12/80	IL33&EFINGH	1330	DRESSER ATLAS	CS&AM	20.0	CI	IND	.0	2.5	1.5	10.0
6/20/80	I57	0930	ELIOT LAKE FRT	U NAT	5.8	CI	LSA	.1	.5	.2	5.0
7/22/80	I57 SCALES	0810	ELIOT LAKE FRT	U NAT	5.8	CI	LSA	.2	.6	.3	5.0
7/25/80	I57	1330	ELIOT LAKE FRT	U NAT	5.8	CI	LSA	.1	.8	.6	5.0
3/17/81	IL3	1050	FEDERAL EXP	XE-133	1.4	CI	MED	.0	.1	.0	.5
9/16/80	OLD MANHEIM	2320	FEDERAL EXP	MIXED	5,186.5	MCI	MED	.1	.4	.0	1.1
9/18/80	LAWRENCE	0610	FEDERAL EXP	RA-BE	4.5	MCI	IND	.1	.2	.0	.5
9/19/80	OLD MANHEIM	2305	FEDERAL EXP	IR-192	46.3	CI	IND	.0	1.0	.0	1.5
9/19/80	LAWRENCE	0550	FEDERAL EXP	MIXED	20.2	CI	MED	.3	.5	.0	2.6
2/25/81	I80	1345	HACKE TRK.	MIXED	16,757.8	MCI	WASTE	.3	26.0	6.0	2.9
2/26/81	I55	1525	HACKE TRK.	MIXED	57,800.0	MCI	WASTE	.2	13.0	1.0	2.6

APPENDIX G

RADIOACTIVE MATERIAL SHIPMENTS
 BY CARRIER AND RADIATION LEVELS
 PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DATE	LOCATION	HOUR	CARRIER NAME	ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS	CAB LEVEL MR/HR	SURFACE LEVEL MR/HR	SIX FT LEVEL MR/HR	TOTAL TI
12/04/80	I80	1145	HACKE TRK.	MIXED	10,449.9	MCI	WASTE	.1	15.6	2.2	6.0
4/08/81	I70 WB	1050	HI COUNTRY C	MFP	6,224.0	UCI	LSA	.1	10.0	.6	10.0
6/09/80	RT333MONTRO	1825	HITMAN NUC	MIXED	4,604.0	MCI	WASTE	.3	6.5	2.5	20.0
7/21/80	US24SCALE	1345	HITMAN NUC	MIXED	1.0	CI	WASTE	.8	60.0	4.0	.0
8/12/80	I74	1715	HITMAN NUC	MIXED	83.0	MCI	WASTE	1.5	7.0	1.0	.0
8/13/80	I74	1530	HITMAN NUC	MIXED	19,832.9	MCI	WASTE	.5	25.0	2.2	32.0
11/13/80	I57	1545	IMMAN NUC FRT	U NAT	10,140.0	MCI	LSA	.2	1.2	.6	.0
9/18/80	LAWRENCE	0350	KHS AIR FRT	RA-BE	4.5	MCI	IND	.0	9.5	.0	.5
7/28/80	I70	1300	LEEWAY FRT.	CS-137	40.0	MCI	IND	.1	.2	.0	1.0
3/23/81	I80 EB	1120	MCCORMACK TRAN	MIXED	22,716.8	MCI	LSA	.2	17.0	1.2	.1
8/26/80	US24 SCALE	1310	MCCORMACK TRAN	MIXED	80,720.0	MCI	WASTE	.0	80.0	6.0	.0
8/22/80	I70	1030	NL INDUSTRIES	U-238	24.2	CI	WASTE	.0	3.0	1.5	20.0
1/23/81	I55 SB	1310	ORSCHLN BR TR	CS-137	.0	CI	IND	.0	.0	.0	3.0
12/10/80	I74 WB	0800	P.I.E.	PU-238	1,820.9	MCI	LSA	.0	.0	.0	.0
9/16/80	KENNEDY	0500	PARKSIDE MOTOR	MO&I31	12,489.0	MCI	MED	1.3	7.0	.0	10.7
9/16/80	KENNEDY	1000	PARKSIDE MOTOR	UNK	.0	MCI	MED	.0	.0	.0	.0
9/17/80	LAWRENCE	0500	PARKSIDE MOTOR	I-131	1.4	MCI	MED	.0	2.5	.0	.4
9/15/80	KENNEDY	1055	PEABODY TEST	IR-192	95.0	CI	IND	.2	11.0	.0	1.3
9/17/80	KENNEDY	2320	PEABODY TEST	IR192	90.0	CI	IND	.2	10.0	.4	.7
9/18/80	KENNEDY WB	1733	PEABODY TEST	IR-192	80.0	CI	IND	.0	1.2	.0	.9
9/17/80	LAWRENCE	0420	PHARMOTOPE	MO99	10.8	CI	MED	.5	5.0	.0	2.0
9/19/80	LAWRENCE	0440	PHARMOTOPE	MO-99	16.6	CI	MED	.4	2.5	.3	2.0
9/13/80	OLD MANHEIM	1202	PRIVATE COUR	MIXED	.0	MCI	MED	.0	8.0	.0	30.1
9/14/80	OLD MANHEIM	1637	PRIVATE COUR	MIXED	1,046.0	MCI	MED	.6	3.5	.5	9.2
9/14/80	OLD MANHEIM	1400	PRIVATE COUR	MIXED	1,680.0	MCI	MED	.8	3.8	.0	10.2
9/14/80	KENNEDY	0905	PRIVATE COUR	MIXED	7,667.0	MCI	MED	1.0	18.0	1.0	57.2
9/15/80	OLD MANHEIM	1418	PRIVATE COUR	MIXED	14.1	MCI	MED	.3	2.3	.0	1.7
9/15/80	HIGNS&MT PR	1725	PRIVATE COUR	MIXED	505.0	MCI	MED	.1	1.5	.0	4.8
9/16/80	OLD MANHEIM	1000	PRIVATE COUR	GA-67	507.0	MCI	MED	.5	4.8	.0	8.2
9/16/80	OLD MANHEIM	1319	PRIVATE COUR	MIXED	197.3	MCI	MED	.4	1.0	.0	1.8
9/16/80	LAWRENCE	1130	PRIVATE COUR	MIXED	3,345.0	MCI	MED	.1	.2	.0	4.8
9/16/80	KENNEDY	2040	PRIVATE COUR	NA-22	5.4	MCI	MED	.1	1.0	.0	5.3
9/16/80	HIGN&ARMSTR	1725	PRIVATE COUR	MIXED	3.5	CI	MED	.1	2.0	.0	6.5
9/16/80	OLD MANHEIM	1442	PRIVATE COUR	MIXED	413.7	MCI	MED	.6	2.5	.0	2.4
9/16/80	OLD MANHEIM	1405	PRIVATE COUR	MIXED	140.2	MCI	MED	.5	.7	.0	1.7
9/17/80	OLD MANHEIM	1235	PRIVATE COUR	NA&I23	30.2	MCI	MED	.1	.8	.0	1.2
9/17/80	HIGN&ARMSTR	1721	PRIVATE COUR	MIXED	129.3	MCI	MED	.1	.7	.0	2.9
9/17/80	KENNEDY	1350	PRIVATE COUR	MIXED	25.8	MCI	MED	1.1	1.3	.0	1.3
9/18/80	KENNEDY	0935	PRIVATE COUR	MIXED	103.2	CI	MED	.6	10.0	3.0	25.8
9/18/80	LAWRENCE	2304	PRIVATE COUR	I-131	1,149.0	MCI	MED	.5	2.4	.0	2.8
9/19/80	LAWRENCE	0904	PRIVATE COUR	MIXED	860.0	MCI	MED	.1	.3	.0	3.2
9/19/80	KENNEDY	1330	PRIVATE COUR	MIXED	1,116.0	MCI	MED	1.0	4.7	3.5	4.9
9/15/80	LAWRENCE	1910	PUROLATOR	TL&GA	26.0	MCI	MED	.3	.3	.0	.2
1/29/81	I474 WB	1705	QUAD CITY TEST	IR-192	58.0	CI	IND	.0	2.0	.0	1.2
11/06/80	IL50MOLINE	1100	REESE&ASSOC	CS-AM	50.0	MCI	IND	.2	.2	.0	.1
2/05/81	I80 WB	1730	RYDER RANGER	U DEP	720.0	MCI	LSA	.0	.1	.0	.0
10/31/80	US51&I80	1716	RYDER RANGER	U DEP	56.0	MCI	LSA	.1	.5	.0	.1
3/12/81	US36&I11	0930	RYDER TRK	IR&CS	500.0	MCI	IND	.1	.3	.0	.3
9/29/80	I5 PLAZA51	0640	SUP.IND.X-RAY	IR-192	33.0	CI	IND	.1	.5	.1	1.8

RADIOACTIVE MATERIAL SHIPMENTS
 BY CARRIER AND RADIATION LEVELS
 PREPARED FOR TRANSPORTATION CONTRACT WITH NRC & DOT

DATE	LOCATION	HOUR	CARRIER NAME	ISOTOPE	QUANTITY	QUAN UNIT	MTRL CLASS	CAB LEVEL MR/HR	SURFACE LEVEL MR/HR	SIX FT LEVEL MR/HR	TOTAL TI
11/03/80	I80	1807	SUP. IND. X-RAY	IR-192	30.0	CI	IND	.1	.3	.0	.5
1/08/81	I80 WB	1655	TRI STATE	MIXED	457.9	MCI	WASTE	.0	.3	.0	.0
2/09/81	I30 WB	1220	TRI STATE	U&PU	100.0	MCI	LSA	.0	.1	.0	.1
3/05/81	I80 EB	1745	TRI STATE	U235CO	49.6	CI	LSA	.0	.0	.0	.3
6/20/80	I57	1235	TRI STATE	U NAT	2.5	CI	LSA	.2	.8	.4	.0
6/25/80	I70	1230	TRI STATE	UF6	3.0	CI	LSA	1.0	2.5	1.5	3.0
8/22/80	I80	1115	TRI STATE	PU-239	13.4	CI	LSA	.0	.0	.0	6.0
8/25/80	I80	1411	TRI STATE	U-235	6,920.0	MCI	LSA	.0	.0	.0	28.8
9/10/80	I80	1705	TRI STATE	MFP	29,000.0	LBS	LSA	.6	6.0	.9	1.5
9/24/80	US51@I80	1455	TRI STATE	MIXED	157.8	MCI	WASTE	.5	30.0	3.0	7.0
10/17/80	I80	2030	TRI STATE	MIXED	8,192.7	MCI	WASTE	.0	.5	.2	15.0
12/07/80	I80 WB	1215	TRI STATE	MIXED	821.0	MCI	WASTE	.0	.4	.0	.0
12/31/80	I30 WB	1400	TRI STATE	MIXED	19,320.0	UCI	WASTE	.1	.7	.1	.0
12/31/80	I80 WB	1005	TRI STATE	TC99M	36,447.0	LBS	WASTE	.0	1.0	.0	4.5
9/19/80	OLD MANHEIM	1640	UNITED AIR	MO-99	527.0	UCI	MED-WAS	1.0	1.0	.0	.3
10/02/80	H. GRAND&MAC	1345	WIS. IND. TEST	IR-192	25.0	CI	IND	.1	.3	.0	1.1
10/20/80	IL116@POST1	0935	WIS. IND. TEST	IR-192	20.0	CI	IND	.0	13.0	.1	.0
3/26/81	I70 WB	1155	YELLOW FRT.	SB124	250.0	MCI	IND	.0	.7	.5	2.0
6/19/80	I57	1340	YELLOW FRT.	U NAT	21,667.0	LBS	LSA	.9	2.4	.9	.0

APPENDIX G

APPENDIX H

EXCLUSIVE USE PAPERS

APPENDIX H

EXCLUSIVE USE VEHICLE PAPERS FOR RADIOPHARMACEUTICAL SHIPMENT WITH TOTAL TI OF 189.8

Maintenance Exclusive Vehicle *

This vehicle has been loaded in conformance with Department of Transportation regulations as defined in the Code of Federal Regulations Title 49 Parts 171-177 (Hazardous Materials Regulations.) It meets the criteria for "exclusive (sole) use" as defined in CFR Section 173.389(o) and conforms to the standards put forth in Sections 49CFR 173.393 (j) and 49CFR 177.842 (a).

This exclusive use vehicle may be loaded in excess of 50 Transport Index provided the vehicle is:

- (1) Assigned for sole use of a single consignor
- (2) Unloaded by the consignee from the transport vehicle in which it was originally loaded
- (3) Not in excess of the following radiation levels (a) 1000 millirems per hr. at three feet from the external surface of any package; (b) 200 millirams per hr. at any point of the external surface of the car or vehicle; (c) 10 millirams per hr. at any point six feet from the external surface of the car or vehicle; (d) 2 millirams per hr. in any normally occupied position in the car or vehicle.

If for any reason it is suspected these Regulations of the radiation profile is broken because of accident, breakdowns, or load shift, contact: Mallinckrodt Diagnostic at 800-325-3689 for instructions.

*This is a reproduction of the exclusive use vehicle papers attached to the shipping papers in the carrier's vehicle.

NRC FORM 335 (7-77)		U.S. NUCLEAR REGULATORY COMMISSION BIBLIOGRAPHIC DATA SHEET		1. REPORT NUMBER (Assigned by DDC) NUREG/CR-2851	
4. TITLE AND SUBTITLE (Add Volume No., if appropriate) Transportation of Radioactive Material in Illinois June 1980 - June 1981				2. (Leave blank)	
7. AUTHOR(S) Maury Neuweg, John Nordin and J. Marty Simonin				3. RECIPIENT'S ACCESSION NO.	
9. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) State of Illinois Office of Radiation Safety Department of Nuclear Safety 1035 Outer Park Drive Springfield, IL 62704				5. DATE REPORT COMPLETED MONTH October YEAR 1981	
12. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) Office of State Programs U. S. Nuclear Regulatory Commission Washington, D. C. 20555 (Sponsored jointly with the U. S. Department of Transportation)				6. (Leave blank)	
13. TYPE OF REPORT Transportation Surveillance Study				7. DATE REPORT ISSUED MONTH July YEAR 1982	
15. SUPPLEMENTARY NOTES 3rd yr: NUREG/CR-2035; 2nd yr: NUREG/CR-1193; 1st yr: NUREG/CR-0756				8. (Leave blank)	
16. ABSTRACT (200 words or less) The fourth year surveillance program was performed with the purpose of continuing the collaborative program between the State of Illinois, the NRC and DOT for the surveillance of radioactive material in surface transport within the State. Information related to handling practices and the condition of packages, adherence to transportation regulations, and other pertinent data was acquired from vehicle inspections. On the basis of the number of reports submitted by State troopers, the surface transit flow of radioactive materials is low. However, the O'Hare Airport Surveillance Study indicates the transit flow of radioactive materials is significantly higher than indicated by highway surveillance studies. Most vehicles surveyed had radiation levels below the DOT limits and that the most frequent violations found were improper shipping papers, improperly prepared or missing shipping labels on packages, and improper placarding. Some recommendations include: A federal agency should offer courses to shippers, carriers, and their drivers explaining DOT regulations concerning radioactive material shipments; A federal agency should develop a specific course on enforcement and interpretation of radioactive material regulations; DOT regulations should be revised taking into consideration the hazardous nature, from a health physics aspect, of low-level shipments of radioactive material; Surveillance of medical radioactive material shipments should be intensified because drivers are exposed to more than the limit of 2 mR/hr.				9. (Leave blank)	
17. KEY WORDS AND DOCUMENT ANALYSIS				10. PROJECT/TASK/WORK UNIT NO.	
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TRANSPORTATION OF RADIOACTIVE MATERIAL IN ILLINOIS

JULY 1982