STATE OF MARYLAND
RADIOACTIVE MATERIALS TRANSPORTATION SURVEILLANCE PROGRAM

Contract No. NRC 06-80-679
Second Quarterly Progress Report
September 8, 1980 - December 7, 1980

INTRODUCTION

Maryland's Office of Environmental Programs (OEP) of the Department of Health and Mental Hygiene conducted a variety of activities under the Radioactive Materials Transportation Surveillance Program contract during the second quarter of the contract period. The period covered by the following report began on September 8, 1980 and ended on December 6, 1980.

Of the four work phases specified in the contract, work was performed in three. Only work in the first phase (traffic pattern determinations), which was completed during the first quarter, was not performed during the second quarter. Phase 2 activities (roadside inspections) during the 2nd quarter consisted of planning functions that would lead to the actual field work during the third quarter of the contract period.

Phase 3 work, which entails the use of sodium iodide crystal detectors to determine patterns in the transport of radioactive material and detect unmarked shipments consisted of the implementation of pilot monitoring efforts. Work in the fourth phase of the program (facilities monitoring) was continued by OEP's Division of Radiation Control.

Specific details of the activities performed under phases 3 and 4 during the 2nd quarter are presented in the following pages.

Phase 3 Activities

Scope of Work

Activities conducted under Phase 3 of the contract were performed by personnel of OEP's Toxic Substances Control Program. The pilot monitoring efforts designed to determine shipping patterns and detect unmarked shipments consisted of highway observations from a State police cruiser and fixed site monitoring at the Francis Scott Key Bridge Toll Plaza.

Survey Procedures

During the highway monitoring portion of the program, one eight hour shift was spent with a Maryland State Trooper on Interstate Highway 95 in

Harford and Cecil Counties, Maryland. Monitoring activities at the Key Bridge Toll Plaza were continuous from 10:30 A.M. October 9, until 9:50 A.M. October 29. During the monitoring efforts of the toll plaza, the radiation detector output was connected to a Rustrak chart recorder, thus giving a continuous monitoring record.

An Eberline Model RM-20-S Monitor with a SPA-4 probe was used in the State Police cruiser while a Ludlum Model 177-10 Monitor with a 44-10 probe linked to the Rustrak recorder was used at the toll plaza. Both probes used a 2 X 2 inch sodium iodide (NaI) crystal as the radiation detector. Each was calibrated with a Cesium-137 source. The source, a Nuclear Chicago Model RT-2 was assayed for 0.492 uCi on February 18, 1960. Since then, the source has decayed to approximately 0.286 uCi of activity.

This lower level of activity produced a calculated exposure rate at 1 cm from the source of approximately 0.87 mR/hr. Extended to 12.5 cm, the expected rate would be 0.005 mR/hr. The detectors were able to meaaure a response at 12.5 cm. Therefore, assuming a point source and an exposure rate of 10 mR/hr (a maximum expected value at six feet from a vehicle) it is reasonable to expect that the instrument would respond to a source at a distance of 268 feet. In moving situations (e.g., on the highway), instrument response time and vehicle speed may , however, act to limit the sensitivity of the detectors.

At the Francis Scott Key Bridge Toll Plaza the instrument was placed in the window of the Associate Administrator's office which has full view of the toll booths. The minimum and maximum distances from the window to the toll booths were 60 and 230 feet respectively. Both north and southbound lanes were covered in this distance. Therefore, considering the calculated range of the instrument (268 feet), all shipments producing an exposure rate of 10 mR/hr should have been detected. The concern about the detection limits as they relate to instrument response time and vehicle speed, would not apply here as all vehicles must stop to pay tolls.

Instrument mounting in the State Police cruiser was on the dashboard. In this monitoring effort, the variable width of the highway median strip, vehicle speeds, and instrument response time would all act to limit the sensitivity of the detector.

Summary of Survey Findings

Radiation levels above background were not detected by the instrument in the State Police cruiser during the 8-hour survey on Interstate Highway 95 in Harford and Cecil Counties.

The recording monitor at the Francis Scott Key Bridge, however, identified 18 shipments of radioactive materials during the 20 days that the detector was in place. The date and time of each indicated shipment is listed in Table I and depicted in chart form in Figure 1.

Fifteen of the shipments passed the toll plaza between the hours of 10:00 A.M. and 5:30 P.M. The other three shipments occurred at the hours of 6:00 A.M., 8:40 P.M. and 10:30 P.M. Arranged by day of the week, the following pattern in the occurrence of the shipments was observed:

Mon.	Tue.	Wed.	Thur.	Fri.	Sat.	Sun
6	4	1	2	2	1	2

As a note of interest, all six of the Monday shipments were on a single date (October 20), while none of the other dates had more than two shipments each.

Evaluations

The data generated at the Francis Scott Key Bridge Toll Plaza is generally consistent with the data generated in the vehicle counting activities conducted during Phase 1 of the study. In that phase of the program, as in this phase, most of the radioactive shipments on the interstate highways in Maryland were indicated to occur during daylight hours.

Performance of the detector unit at the toll plaza indicated that we can establish monitoring systems at various locations around the State and collect useful information on shipping patterns or radioactive materials. Data collected in this manner can be obtained without the knowledge of the trucking industry. This would eliminate any problems that could develop if truckers deliberately avoid manned monitoring locations.

The shipping pattern observed at the toll plaza may or may not be typical. More data will need to be obtained to firmly establish shipping patterns.

TABLE I

INDICATED SHIPMENTS OF RADIOACTIVE MATERIALS
AT THE FRANCIS SCOTT KEY BRIDGE TOLL PLAZA

Between

10:30 A.M. Oct. 9, 1980 and 9:50 A.M. Oct. 29, 1980

	Day of Week	Date	TIME A.M.	TIME P.M.
1.	Saturday	11		12:30
2.	Tuesday	14		1:35
3.	Wednesday	15		1:20
4.	Thursday	16		10.30
5.	Friday	17		1:13
6.	Monday	20	10:10	
7.	Monday	20	11:05	
8.	Monday	20	11:10	
9.	Monday	20	11:20	
10.	Monday	20		4:20
11.	Monday	20		4:50
12.	Tuesday	21		4:30
13.	Thursday	23		1:36
14.	Friday	24		2:20
15.	Sunday	26	6:00	
16.	Sunday	26		8:40
17.	Tuesday	28		2:50
18.	Tuesday	28		5:30

DATE AND TIME OF INDICATED SHIPMENTS OF RADIOACTIVE MATERIALS
AT THE FRANCIS SCOTT KEY BRIDGE TOLL PLAZA
October 1980

Day of Week	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed
Day of Month	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
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Δ = Radioactive Material Shipments Recorded.

Phase 4 Activities

Activities conducted under Phase 4 of the contract were performed by personnel of OEP's Division of Radiation Control. Efforts under this phase of the contract consisted primarily of facilities inspections. Marine terminal inspections were conducted at the Dundalk Marine Terminal (8) and the Locust Point Marine Terminal (1). Two courier - transportation companies (Purolator and Federal Express) were also visited to check for compliance with shipping regulations and to determine personnel exposure levels. In addition to these activities, visits were made to the Calvert Cliffs Nuclear Power Plant in Calvert County and to Interstate Uniform Services, Inc. in Howard County to monitor radiation levels.

In addition to these activities, contact was made with a representative of the U. S. Coast Guard to obtain information on the shipping of radioactive materials in the Port of Baltimore. They indicated that on the average, one shipment per week of uranium is handled by the Port. The Maryland Port Administration's 1979 Annual Report indicated that approximately 2-3/4 million pounds of freight labeled as radioactive material has been handled by the Port in that year. Considering the lack of notification to the Division of Radiation Control concerning shipments of radioactive materials, the Coast Guard reported shipping frequencies of uranium and the large quantity of material shipped in 1979, some concern exists about the adequacy of the notification procedures that should be in place. This problem will need to be addressed.

The results of the facilities inspection activities are presented in the following list and summarized in Table 2.

FACILITIES INSPECTION RESULTS

Dundalk Marine Terminal Surveys

9/18/80 Four cylinders (3' X8') of solid UF-6 being shipped by Hapag-Lloyd were inspected. An attached sign indicated the contents of the cylinders contained U-235 with 33 curies per cylinder. Destination of the shipment was Brenin, Germany. The Transportation Index (T.I.) was overstated on the labels. The listed T. I. on the labels was 5.0 while the measured value was 0.15 mR/hr.

9/23/80 A shipment of four Thermoelectric Generators from Teledyne Energy Systems was inspected. A total activity of 387,000 Curies was being shipped. Radioactive materials consisted of Strontium 90 Floride and Sr-90 special form. The T.I. was 2.7 mR/hr and was comparable to the shipping documents. Contamination wipes produced 6.2×10^{-7} and 9×10^{-5} uCI/100 cm^2.

10/7/80 A shipment of depleated U-238 (1000 lbs.) in 26 palletized containers being sent to Switzerland from Transnuclear Corp. of Virginia was inspected. The measured and listed T.I. was 0.6 mR/hr. The average activity per box wss between 170 and 180 mCi. All package labeling was in compliance with regulations.

10/14/80 An incoming shipment from Durban, South Africa to Richland, Washington consisted of 402 fifty-five gallon drums of uranium concentrates. The T. I. was overstated on the label at 6.0 while the actual measured value was 0.8 mR/hr. All other labeling was appropriate.

10/14/81 Notification was received from the Maryland Port Administration which indicated the presence of weathered boxes of radioactive materials at the terminal. An investigation revealed that these boxes were part of a shipment bound for Iran that had been delayed for over one year. The boxes were determined to contain Troxler moisture density gauges. No radiation hazard was noted.

10/15/80 A high security shipment of enriched uranium being sent from Union Carbide to France was inspected. The uranium was the only item contained in the exclusive use vehicle that was carrying the material to the terminal. An overstatement of the T. I. was noted. The labels indicated a value of 0.1 while the actual measured value was 0.05 mR/hr.

10/15/80 A survey of 8 cylinders of UF-6 (destination unknown) was conducted. Shipping documents were unavailable. No radiation hazard was noted.

10/17/80 A shipment from Advanced Material Systems containing 2869 Curies of Cobalt-60 special form (Teletherapy source) was surveyed.

Locust Point Marine Terminal Survey

10/17/80 A type B shipping container labeled, "empty" and being returned to Picker from South America, was surveyed. No T.I. was listed for the shipment. A measured T. I. of 0.2 was obtained in addition to a surface reading of 2.0 mR/hr. An inquiry to Advanced Medical Systems revealed that the container was not empty, but contained 545 Ci of Cobalt-60. The returning shipment originated from Scientifica, Argentinia and was being sent to Cleveland, Ohio. Contamination checks performed on the shipping container revealed no contamination greater than 8×10^{-6} uCi/100 cm^2 .

Transportation Company Surveys

10/2/80 and 10/3/80 Purolator Courier Corporation on Moravia Park Drive in Baltimore was surveyed for radiation levels. Area thermoluminescent dosimeters were placed in the facility and were provided to several employees. Only one positive reading was obtained from these monitoring devices and that value was 10 mR. Two vehicles were observed at the facility that had placarding violations. One contained RAM III packages but did not have any external placards. The other violation was noted when a RAM III placarded vehicle contained only RAM II packages. In this instance no placards should have been displayed. Company management was alerted to the violations.

Transportation Company Surveys (Continued)

10/23/80 and 10/24/80 — Personnel at the Federal Express Transportation Company were provided with 7 TLD badges. Also, 4 area dosimeters were installed. The readings from these devices were all negative. During the visits to the facility, six packages containing radioactive materials were surveyed. No deficiencies were noted.

11/6/80 — Another survey of the previously identified Purolator facility was conducted. Nine packages including six that required labeling were examined. It was noted that the manufacturers generally listed the surface dose rate instead of the value at 3 feet as the T.I. Most of the packages had been shipped from New England Radiopharmaceutical Manufacturers. Personnel TLD badges previously provided were exchanged. The readings from these devices are not yet available.

Calvert Cliffs Nuclear Power Plant

12/5/80 — Extensive preparations were necessary to gain admittance to this Baltimore Gas and Electric Company facility. During the survey contaminated laundry that was to be cleaned and returned was examined. Shipping documents and contamination levels were also examined. Shipments of both wastes and laundry were found to be higher during outage periods. Normally, up to one truck load of laundry is shipped each week. During outage periods, the facility ships up to one load each of high and low level wastes every two weeks. No deficiencies were noted during this survey.

Other Surveys

10/27/80 — At the request of the Maryland Department of Transportation, a survey of the laundry trucks of the Interstate Uniform Services Company was conducted. It was determined that the firm handles only industrial laundry . No radioactive materials or violations were identified.

Companies Contacted During 2nd Operating Quarter

Couriers	-	Purolator Federal Express
Public Agencies	-	Maryland Port Administration U.S. Coast Guard Port of Baltimore Marine Terminals
Manufacturers	-	Advanced Medical Systems
Shippers/Freight Handlers	-	Hapag-Lloyd Ramsey-Scarlitt Yellow Truck Lines
Electric Power Company	-	Baltimore Gas and Electric Company - Calvert Cliffs Nuclear Power Plant

Shipper Deficiencies Noted During Survey

(1) Mallinchrodt Shipment to Johns Hopkins Hospital
Transported By Purolator on 10-3-80
Type package - 7A
Isotope - I-131
Activity - 0.151 Ci
T.I. list - 1.5
Labels - two type III, No placard displayed on vehicle
Surface Radiation Level - 18.0 mR/hr.
Size Package - 2' x 1' x 1'
Courier - Purolator-Baltimore, Maryland - Management Notified

(2) Squibb Shipment to St. Joseph Hospital 10-2-80
Two packages
Type package - 7A
Activity - .0012 Ci
Isotope - Se-75
List T.I. - 0.3 & 0.4
Labels - Two II's - Placards Displayed, None required
Purolator-Baltimore, Maryland - Shipper-Management Notified

SUMMARY OF FACILITIES MONITORING EFFORTS
DURING 2nd QUARTER OF RADIOACTIVE MATERIALS
TRANSPORTATION SURVEY

Table 2

*Deficiencies

Facility	Destination	Type Package	Radioactive Materials	Date	In Compliance	Area or Personnel Monitoring	Deficiencies Noted	Remarks
Dundalk Marine Terminal	Brenin, Germany	4 Steel Cylinders	U-235 3.3 Ci @	9/18/80	Yes	No		
Dundalk Marine Terminal	Israel	5 Shipping Containers Thermo-electric Generators	Sr-90 387,206 Ci Total	9/23/80	Yes	No		
Purolator Courier Corp.	Maryland	Eight 7A Boxes	Ir-192, I-131, I-125 Se-75	10-2-80	No	Personnel and Area	*Vehicle not placarded	Vehicle placarded when not required.
Dundalk Marine Terminal	Switzerland	Wooden crates banded	Depleted Uranium-238	10-7-80	Yes	No		
Dundalk Marine Terminal	Iran	23 Fiber-board box-es over specifica-tion con-tainers(7A)	Cs-137 - Am-241 Soil Density Gauges	10-14-80	Yes	No	No	Packages discovered, waiting shipment.
Dundalk Marine Terminal	State of Washington (Exxon)	Sealed containeri-zed Steel Drums Ten con-tainerized Units	Uranium concentrates	10-14-80	Yes	No	*T.I. overstated in all container labels.	
Dundalk Marine Terminal	France	One 6 m specifica-tion con-tainer (20 gallon)	Enriched Uranium	10-15-80	Yes	No	No	
Dundalk Marine Terminal	Unknown	8 cylin-ders	UF-6	10-15-80	Yes	No	*T.I. overstated	Shipment not reported to MPA

Table 2 (Continued)

CONTRACT SURVEYS

*Deficiencies

Facility	Destination	Type Package	Radioactive Materials	Date	In Compliance	Area or Personnel Monitoring	Deficiencies Noted	Remarks
Locust Point Marine Terminal	Advanced Medical Systems	Source Shipping Container	Empty	10-17-80	No	No	*Package listed empty but contained depleted Co-60 source 545 Ci.**	
Dundalk Marine Terminal	West Germany	Source Shipping Container	Co-60 - 2869 Ci	10-17-80	Yes	No	None	
Federal Express	Maryland	7A containers	I-125 and Co-57	10-23-80	Yes	Yes	No	Packages remain in area for one hour.
Interstate Uniform Services Investigation	Pennsylvania or M.S.DOT	Laundry Trucks	None	10-27-80	Yes	No	No	Firm handles industrial laundry only
Purolator Courier	Maryland	7A type containers	Co-57, Se-75 I-131, and I-125	11-6-80	No	Yes	*T.I. listed was higher than required minor T.I. deficiencies	1 mCi several uCi packages.
Calvert Cliffs Nuclear Power Plant	New York	55 gal. drums	Co-60 (0.016 Ci)	12-5-80	Yes	Yes Company Supplied (Not Contract)	None	Contaminated laundry being returned for washing.

**Documentation forwarded to U.S.DOT