

RADIOACTIVE MATERIAL TRANSPORTATION SURVEILLANCE

CONTRACT # NRC-06-78-357

FIRST QUARTERLY PROGRESS REPORT FY 81

(October 1, 1980 - December 31, 1980)

OVERVIEW

Observations made during the period from October 1, 1980 to December 31, 1980, are summarized in this report. The transportation surveillance contract was carried out by the Bureau of Radiological Health, South Carolina Department of Health and Environmental Control, Columbia, South Carolina.

The principle objective of the radioactive material surveillance program was to evaluate shippers and carriers for compliance with DOT packaging and shipping regulations. Although not included in this report, routing information was obtained on all waste shipments coming into South Carolina.

Shipments having minor discrepancies represented less than five percent of the total number inspected during the first quarter. Only two shipments or approximately .15 percent of those inspected had discrepancies which the Bureau felt warranted punitive action. The most significant hazard during this quarter appears to be the poor mechanical condition of some transport vehicles. Mechanical flaws such as broken or cracked frame and suspension members and worn or loose tires could lead to serious accidents. External removable contamination did not appear to be a problem with most shipments. The tables included compile and tabulate all the collected data.

The origin and types of low level radioactive waste shipments were identified as follows:

1. Nuclear Power Plants and Research Reactors
 - a. Spent resins and filters used to remove radioactive contaminants and corrosion products from primary cooling systems.
 - b. Concentrated solidified sludges.
 - c. Contaminated or irradiated metal components and equipment. (Pumps, fuel racks, piping, etc.)
 - d. Contaminated water solidified with a media such as concrete.
 - e. Contaminated paper, protective clothing, wood, building rubble, and other general trash.

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2. Academic, Commercial and Government Research Laboratories and Hospitals
 - a. Radioactive contaminated general laboratory trash such as glassware, paper, lab clothing, gloves, culture dishes, syringes, etc.
 - b. Animal carcasses containing residual radioactive tracers.
 - c. Sealed radioactive sources used in instrument calibration and research.
 - d. Solidified aqueous solution containing radioactive contaminants.
3. General Industrial and Nuclear Fuel Processing Facilities
 - a. Sealed radioactive sources from gauging devices.
 - b. Depleted Uranium slag resulting from the manufacture of shielding devices and weapon's projectiles.
 - c. Uranium slags and slurries generated as the result of nuclear fuel fabrication and processing.
 - d. Piping, wiring, metals, and other hardware with induced radioactivity from particle accelerators.

Some types of packages and containers used to ship and transport low level radioactive waste were identified as follows:

1. 30 or 55 gallon metal drums with rim lock bands
2. Mild steel cask liners (100 - 300 cubic feet)
3. Large reinforced wooden crates
4. Type A or Type B shipping casks
5. Transfer "pigs" (various sizes and shapes)
6. Large metal tanks or large steel containers
7. Items wrapped in heavy polyethelene or herculon
8. Bulk material in covered dump truck (not requiring packages)

The types of motor transport vehicles identified were as follows:

1. Tractor/trailer, enclosed vans (hard or canvas top)
2. Flat bed trailers with large crates, metal tanks, or with shipping casks
3. Step deck trailers with shipping casks permanently or temporarily mounted
4. Low boy trailers with shipping casks permanently or temporarily mounted
5. Straight trucks and delivery vans
6. Pickup trucks

Procedures

The inspections were performed at the Chem-Nuclear Systems, Inc. site near Barnwell by trained inspectors of the Bureau of Radiological Health (BRH), South Carolina Department of Health and Environmental Control (DHEC).

Arriving shipments were inspected prior to their moving on to the trench site area for off-loading. A normal sequence for inspection by BRH involved the following procedure:

1. Inspect vehicle for DOT placards.
2. Inspect security seals on closed vans or casks.
3. Inspect packages and containers for labels, markings, seals, specification packaging, damage or leakage.
4. Inspect shipping cask for labels, markings, seals, lid bolts, tie-downs, mounting bolts, damage or leakage.
5. Inspect tractor and trailer for obvious defects such as tires, lights and structural failure of trailer.
6. Survey vehicle with portable radiation detection instruments to determine radiation levels at surface, six feet and at driver's position.
7. Take smears on outside of closed vehicle and on flat beds, low boys, etc. Take smears on inside of trailer vans when possible.
8. Take smears from casks, containers, and representative packages.
9. Inspect all shipping papers.
10. If discrepancies indicate a need follow truck to trench site for inspection and surveillance of packages, containers, and cask during off-loading.
11. Note any discrepancies during and following off-loading of packages.

From October 1, 1980 to December 31, 1980 the Bureau of Radiological Health maintained an inspector on-site every weekday and all incoming vehicles were inspected and surveyed. A total of 1,253 vehicles were inspected during the contract period.

A small percentage of individual packages are surveyed and monitored at the burial site by the state inspector. In some instances a shielded cask with a resin liner could be considered as one package or container. For van shipments specific packages were selected and isolated for inspection and survey.

Thermoluminescent dosimeters (TLD) were placed around the Chem-Nuclear Systems site, at adjacent transportation terminals operated by Home Transportation Company, and at truck stops or intersections along heavily used routes. The location of these TLD monitors are listed in Table V.

RESULTS AND DISCUSSION

Major highway routes used by carriers of low-level waste shipments in South Carolina have been previously identified during the contract study. For the most part highway carriers utilized the interstate and major highways whenever possible. Although the state inspector was not required to perform vehicle safety or mechanical inspections some trucks did arrive at the inspection point with minor mechanical flaws such as loose or worn tires, broken frame members, and leaking exhaust pipes. These observations represented no more than two percent of the 1,253 trucks inspected. Table I shows the total number of discrepancies noted.

The tractor/trailer or vehicle was inspected for DOT placards. If a radioactive DOT placard was on the front of the trailer but not on the front of the tractor this method of placarding was acceptable and not recorded as a discrepancy under "PLACARDING" Table II. Only 10 trucks were cited for missing placards. Also listed under "PLACARDING" in Table II are only violations relating to improper or lack of labeling. Four shipments were cited during the period for this violation.

Radiation measurements were made at the surface of closed transport vehicles and at six feet from the surface. Radiation measurements on open vehicles were made at the vertical plane (surface reading) of the trailer and a six feet. Radiation readings were taken in the tractor cab at the driver's position. If readings were considered significant, then more detailed surveys were made in the sleeper compartment if one existed. Only two shipments were cited for marginally exceeding allowable radiation levels. Other discrepancies listed under "RADIOLOGICAL" in Table II were four leaking containers (contaminated soil) and one improperly sealed 17-H 55 gallon steel drum.

As a part of the inspection procedure packages and/or containers were checked to determine if they were secure for transportation. Bracing and blocking, tie-downs, straps, and other restraints were checked. As indicated under "RESTRAINTS" in Table II only a few discrepancies of this nature were noted.

Shipping papers were reviewed as part of the inspection procedure. As indicated in Table II one of the most common discrepancies found on shipping papers was failure to include exclusive use instructions.

Smears for possible contamination were taken using 45 millimeter "Nu-Con" wipes inside vans and on the deck of flat bed or low boy trailers. Smears were also taken on the outside surfaces of casks and around the cargo doors on vans. As indicated by results listed in Table III contamination that was detected on trailers never exceeded the limits set forth in the DOT regulations.

The personnel exposure survey was limited to examination of the available exposure reports of truck driver exposures. Due to the time lag in submitting badges for reading and receiving reports from the vendors, the information on exposure to drivers of radioactive waste shipments for this reporting period is limited. The available data is reported in Table IV. Future quarterly reports will include all information as it becomes available from the carriers.

Table V is a tabulation of the results of the TLD Area Monitors used as part of the survey. The Control TLD was posted outside the Bureau office in Columbia, 70 miles away from the Barnwell area. The average mrem per day exposure for this badge was 0.27 and has not been subtracted from any of the results shown in Table V. Sample number 80-0625 showed the only significantly elevated radiation levels. This monitor was located in close proximity (5 meters) to the truck inspection and waiting lanes at Chem-Nuclear and would therefore be exposed on a continuous basis to whatever small radiation fields might be presented by waiting trucks.

Inspection of radioactive material packages at medical, academic, and industrial licenses was incorporated into the contract program. Even though no discrepancies in shipping regulations were noted, these locations will continue to be used as points of surveillance. During the next quarter, this program will be expanded to include package inspections at other trucking terminals and package expeditors. This surveillance will also include collection of individual exposure data.

For information purposes, scale drawings of the truck terminals located at the Chem-Nuclear Site have been included with this report. (see figures 1, 2, 3). These areas are included in the TLD monitoring program.

CONCLUSIONS

In general it was found that low-level radioactive waste was being packaged and transported in a safe manner. It did become obvious that when discrepancies were found they usually were the fault of the shipper (originator) of the material. In most cases, during the period of this report, there was little evidence to indicate that an inspection of the shipment had been made by any government regulatory agency (NRC or DOT) prior to the material leaving the originator. Inspections for compliance with the regulations was performed by the shipper (originator).

FIGURE 1:
Chem-Nuclear Systems, Inc.

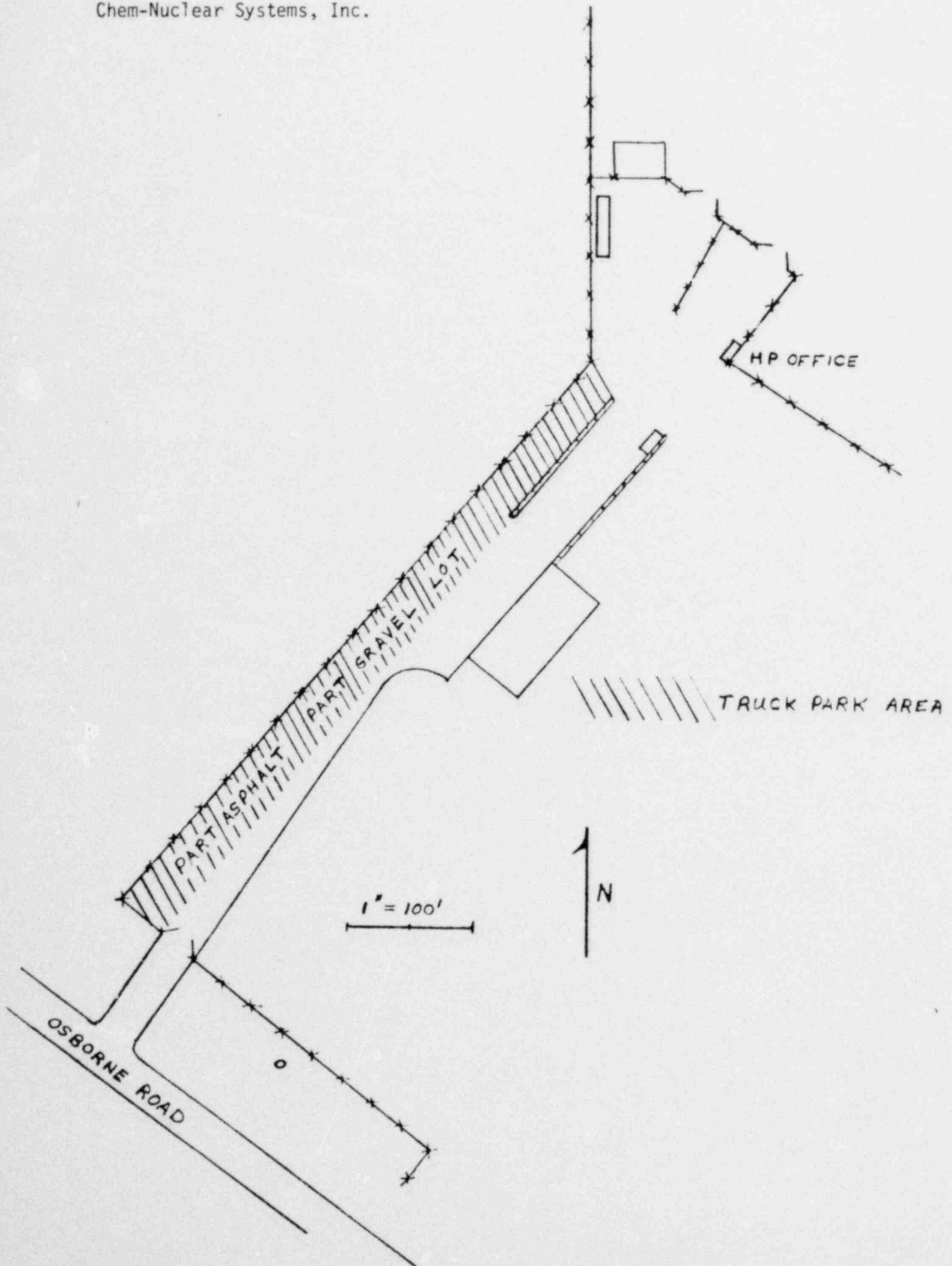


FIGURE 2:

Home Transportation Company

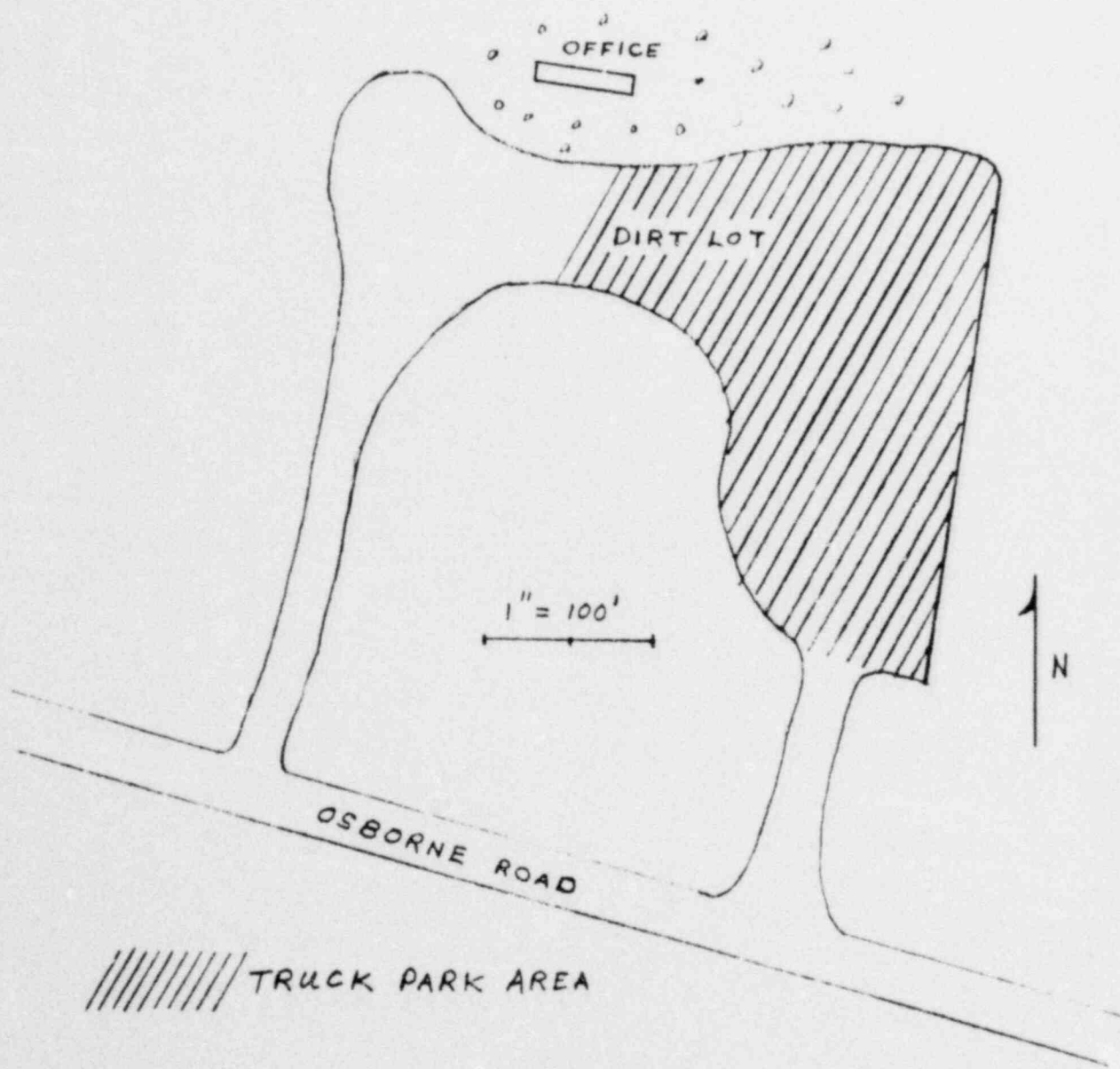


FIGURE 3:

Tri-State Motor Transit

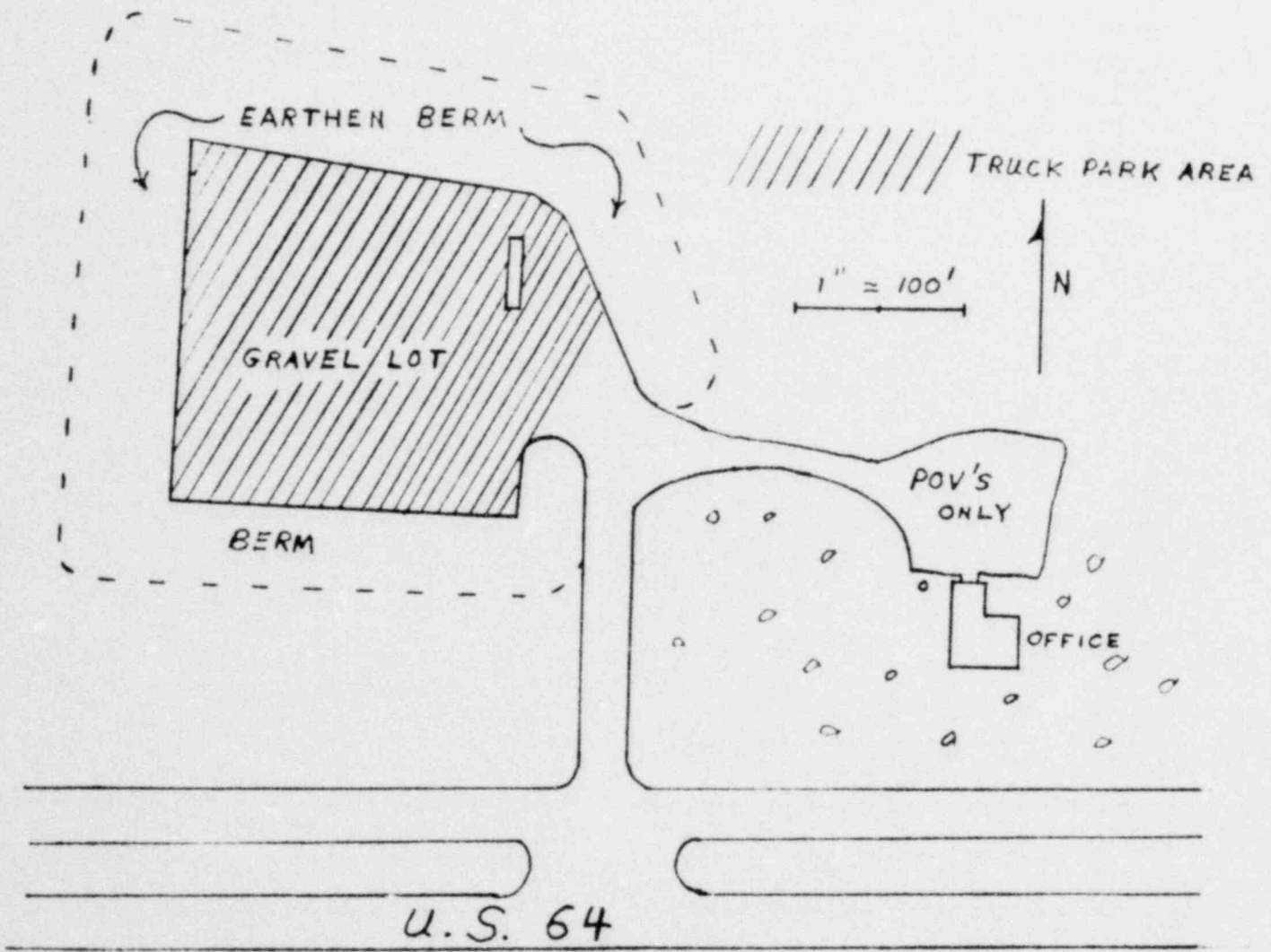


TABLE I

FIRST QUARTER TRUCK INSPECTIONS AT CHEM-NUCLEAR

<u>MONTH</u>	<u>Total # Insp.</u>	<u># with Discrepancies</u>	<u>% of Total</u>	<u>Total # of Discrepancies</u>
OCTOBER	478	12	2.5	22
NOVEMBER	374	18	4.8	20
DECEMBER	401	20	5.0	22
	—	—	—	—
TOTAL	1,253	50	3.2	64

TABLE II
TYPE OF DISCREPANCY

MONTH	Total #	Road ¹ Worthiness	Paperwork ²	Radiological ³	Placarding ⁴	Restraints ⁵
OCTOBER	22	1	9	3	8	1
NOVEMBER	20	14	3	1	2	0
DECEMBER	22	10	2	3	4	3
TOTALS	64	25	14	7	14	4
% Total	100	39	21.9	10.9	21.9	6.3

¹ROADWORTHINESS - Includes flat tires, leaking exhausts, fractured or broken frame members and springs, missing bolts, nuts, wheel wedges, etc. and damaged tire rims.

²PAPERWORK - Includes missing or inadequate exclusive use instructions, shippers' certification.

³RADIOLOGICAL - Includes excessive radiation fields, leaking containers, improperly closed containers.

⁴PLACARDING - Includes improper labels, lack of placards or labels.

⁵RESTRAINTS - Includes lack of proper blocking or braces, lack of tie downs and or loose tie downs.

TABLE III
 SMEAR* SAMPLE RESULTS
 (Incoming Shipments)

<u>DATE</u>	# Shipments (smears/shipment)	DPM/100cm ² (Beta, Gamma)	
		<u>High</u>	<u>Average</u>
12-2	15 (3)	42.7	5.4
12-4	2 (3)	9.4	3.2
12-5	2 (3)	868.9	226.3
12-16	2 (3)	288.6	50.5
12-18	2 (3)	203.6	60.7
12-30	4 (1)	8.3	3.9
12-31	1 (3)	93.5	71.9

* Dry 45mm "Nu-Con" wipes were used to take smears of sample areas approximating 100 square centimeters. Samples were analyzed using a gas flow proportional system. Counting times of two minutes per wipe were used.

TABLE IV

TRUCK DRIVER EXPOSURE DATA

<u>MONTH (1980)</u>	<u># Reporting Personnel</u>	<u>Average mrem/man</u>	<u>Reported High MR</u>	<u>Comments</u>
August	20	2	21	
September	21	9	48	
October	26	12	47	

TABLE V

DIRECT RADIATION EXPOSURE MEASUREMENTS
USING LiF THERMOLUMINESCENT DOSIMETERSOctober 1 to December 31, 1980
(92 Days)

Station Number, Location	Total mrem For Period	Aveg mrem Per Day
Chem-Nuclear Systems, Inc. Barnwell, S.C.		
80-6131 Drivers Lounge	35	.38
80-6132 Security Office	30.4	.33
80-6133 Lounge & Canteen	29.4	.32
80-6134 Receptionist Desk	32.2	.35
80-0644 Traffic Control Gate	36.8	.40
80-0646 Fence, East Side	21.2	.23
80-1409 On-site Picnic Area	38.6	.42
80-1452 Jct. of Roads 585 & 586	25.8	.28
80-0603 Osborn Rd., Front Entrance	17.5	.19
80-0625 Fence Along Truck Inspection Lane	239.2	2.6
80-0645 Fence, North Side	16.6	.18
Home Transportation Company Barnwell, S.C.		
80-6118 Inside Office	13.8	.15
80-6119 Outside Office	13.8	.15
80-6130 East Gate on Osborn Road	12.9	.14
80-1451 East Side of Terminal Property	16.6	.18
S.C. #64, Moore's Store Snelling, S.C.		
80-1453	15.6	.17
S.C. #64 at Barnwell City Limits Barnwell, S.C.		
80-0617	16.6	.18
AMCO Station, U.S. #78 Williston, S.C.		
80-6120	21.2	.23

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Station Number, Location	Total mrem For Period	Aveg mrem Per Day
Jct. of S.C. # 19 & U.S. #278 New Ellington, S.C.		
80-0104	19.3	.21
Truck Stop, Ft. Watson Motel Santee, S.C.		
80-6150	South End of Motel	Vandalized
80-6151	Sewage Plant	13.8
80-6152	Fence, North	10.1
80-6153	Exxon Station	16.6
80-6154	Fence, Repair Shop	12.9
80-6155	Restaurant, South Side	Vandalized
80-6156	South Side of house Trailer	9.2
Truck Stop, Safe Haven Area Manning, S.C.		
80-6157	Fence	12.0
80-6158	Warning Sign	12.9
Control Badge Bureau of Radiological Health Columbia, S.C.		
80-0001	2600 Bull Street	24.8