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M E M O R A N D U M

TO: D. W. MOELLER, CHAIRMAN
ACRS SUBCOMMITTEE ON REACTOR RADIOLOGICAL EFFECTS

FROM: D. A. ORTH, CONSULTANT *DAO*

REVIEW OF NRC AND DOT TRANSPORTATION REGULATIONS AND EXPERIENCE

References: 1/5/83 letter, R. C. Tang to D. W. Moeller, Revision to 10CFR Part 71 - Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions.

11/22/82 Letter, R. B. Minogue to R. F. Fraley, 269th ACRS Meeting Actions Recommendations and Requests.

Reference 1 notes the concern over the high external radiation levels permitted by DOT standards for shipment of radioactive materials and illustrates the point with a hypothetical shipment of TMI waste to Hanford, Washington. Reference 2 included the staff analysis that concluded that both DOT and NRC regulations were equivalent in assuring that occupational exposures of transport workers and general public exposures would not exceed internationally accepted limits. Although the primary conclusion was that there were no problems, the staff did note that operations involved in radioactive shipments were being analyzed to determine whether Part 20 type controls would promote ALARA and what further controls might be required. The references cited in the staff analysis do not support a finding that there is no problem and certainly support further studies, based on the following points:

1. The reference documents are studies of small packages, primarily medical isotopes, and simply do not address large shipments;
2. The studies did find a considerable number of exposures over the limits, with the real extent of doses unknown because the DOT regulated shipments are exempt from the worker measurement and protection requirements of 10CFR Part 19;

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3. The studies specifically drew the conclusion that doses to transport workers were not as low as reasonably achievable;
4. The position that public doses would be negligible rests on the Environmental Statement on transportation and an assumed momentary exposure to a spent fuel cask, without consideration of repetitive high-level waste shipments.

The points above can be amplified. The two most pertinent surveys are NUREG-0393, on the state surveillance program, and MUREG/CR-2200, on exposures of transportation workers. The state surveillance program involved package handling by freight forwarders in six states and New York City, during periods between 1972 and 1976. The handling of many small packages, primarily medical isotopes, is not directly analogous to large shipments, but some of the observations and recommendations are pertinent. Among the conclusions, depending on the state, were that there were gaps in the regulations with regard to exposures of freight forwarder workers, that actions should be taken to mitigate exposures, that terminals handling large quantities of radioactive materials should be licensed and the personnel considered to be radiation workers, and that monitoring should be instituted. Annual personnel exposures were projected from 3 month measurements on selected workers and a number were above the 500 mrem/yr standard for the general public in six of the eight states, though below the radiation worker standard of 5000 mrem/yr, hence the recommendation that terminals should be made restricted areas and the personnel be treated as radiation workers. Also, maximum dose rates in vehicle cabs in different states were found to be 3.5, 4.5, 6, 7, 15, and 30 mrem/hr. As noted in the report, the 2 mrem/hr limit at the driver's seat is for sole use vehicles under DOT regulations, but there are no such limits for other vehicles.

The second study on transportation workers in seven facilities took place between 1979 and 1981. Among other purposes, the study was to identify facilities and carriers where employees could receive more than 500 mrem/yr (i.e., might be considered radiation workers). As before, the study concerned the handling of many small packages, primarily medical isotopes. The conclusions were straightforward: some workers were receiving more than 5,000 mrem/yr; exposures were not as low as reasonably could be achieved; exposures could be reduced significantly if DOT and NRC recommendations for handling radioactive packages were followed. One recommendation was that dosimetry data be reviewed annually by NRC or DOT for those cases where dosimetry (not required) might be available. Also recommended was an effort to have subcontract drivers that use their own vehicles adhere to exposure rate requirements.

These studies on small packages, as noted previously, are not applicable to large shipments except to demonstrate that the present regulatory system does have problems in controlling exposures. Large shipments are treated in NUREG-0170, FES on the Transportation of Radioactive Material by Air and Other Modes, in Section 4.3.2. Here maximum doses to the drivers are calculated based on the 2 mrem/hr limit in the cab, a 20 hour trip 30 times a year, and 1 hour work per trip at 1 meter from a fuel cask reading 33 mrem/hr at that distance. The calculated maximum annual dose is 2.2 rem, with a probable annual dose of about 870 mrem. Probable dose to a bystander is calculated on the basis of 3 minutes in a 25 mrem/hr field at one meter from a cask, with this negligible amount the probable annual dose unless the bystander investigated several shipments. However, these cases do not really address the issue of multiple high-level waste shipments, as raised in Reference 1. Exposures for the drivers well could be worse, considering the long drives and possible exposures to dose rates greater than the assumed 33 mrem/hr if the external wall of the vehicle is 200 mrem/hr and the driver makes the typical routine checks at stops, as well as helping with the unloading. The bystander case also differs from the FES analysis, because it can be assumed that drivers will settle into a routine for rest stops for food and fuel. There will be opportunities for repeated exposures of personnel at service stops, again at fields potentially higher than 33 mrem/hr.

The questions that have been raised with respect to DOT and NRC regulation of transportation and control of doses do not appear to be answered in Reference 2. The staff analysis does refer to two current studies, one on whether Part 20 type controls over transportation operations with potentially high exposures would promote ALARA, and the other on whether controls on storage of and access to radioactive material shipments are needed. It appears that the answers in both studies should be positive and it may be hoped that some new controls will be instituted eventually.