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STUDIES INVOLVING PROPOSED WASTE DISPOSAL FACILITIES IN TURKEY*

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The Turkish government is in the process of planning two nuclear reactors in Turkey. Turkish Atomic Energy Authority has been given the task to develop plans for improved control of low level wastes (LLW) in Turkey. Today principal sources of radioactive wastes are hospitals, research institutions, biological research centers, universities, industries and two research reactors in Turkey. These wastes will be treated in a pilot waste treatment facility located in Cekmece Nuclear Research and Training Center, Istanbul. In this temporary waste disposal facility, the wastes will be stored in 200 liter concrete containers until the establishment of the permanent waste disposal sites in Turkey, in 1990 (1).

The PRESTO - II (Prediction of Radiation Effects From Shallow Trench Operations) computer code (2-3) has been applied for the general probable sites for LLW disposal in Turkey. The model is intended to serve as a non-site specific screening model for assessing radionuclide transport, ensuing exposure, and health impacts to a static local population for a chosen time period, following the end of the disposal operation. The methodology that this code takes into consideration is versatile and explicitly considers infiltration and percolation of surface water into the trench, leaching of radionuclides, vertical and horizontal transport of radionuclides and use of this contaminated ground water for farming, irrigation, and ingestion.

Humans may be exposed to radionuclides from LLW sites by several ways. Water is the most important medium for transporting radioactivity from shallow trenches. Water falling on the waste disposal area may either infiltrate or runoff the surface, or evaporate (4-5). Ground water or precipitation entering the trench may mix with the waste material and became contaminated. Radionuclides in water near the soil surface may be transported to a surface water body or may reenter the trench seepage.

Humans may also be exposed to radionuclides transported from LLW sites by atmospheric processes (6). Radionuclides left on the soil surface by trench overflow, by spillage during disposal operations, or by complete removal of the trench cap may be suspended in the atmosphere and transported downwind where they may be inhaled or deposited on soil. There are several other methods by which humans may be exposed to radioactivity from LLW disposal site, and which are considered in the PRESTO - II methodology (7-8).

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Processes considered in calculating individual or population exposures include: ground water transport, precipitation, runoff, trench water overflow and seepage, chemical exchange, leaching, trench cap erosion, stream dilution and atmospheric dispersion of contaminated soil followed by inhalation or deposition on crops and land.

Preliminary simulation using the PRESTO - II computer code has been run for the site in Koteyli - Balikesir, Turkey. This example simulation was performed using the same radionuclide data set believed representative of the LLW disposal facility in Barnwell, South Carolina. Site environmental variables were selected to typify credible worst case exposure scenerios. Radionuclide inventories are primarily based on estimated waste composition rather than measured values. The results are tabulated in Table I . Using the same radionuclides data set, Koteyli Turkey Site annual intake by ingestion is higher than the Barnwell South Carolina site; however values are approximately equal in the case of annual intake by inhalation.

TABLE - I

Output Values of PRESTO II for Barnwell and Koteyli Turkey (pci/y)

Nuclide	Annual Intake by Ingestion, Barnwell	Annual Intake by Inhalation, Barnwell	Annual Intake by Ingestion, Koteyli Turkey	Annual intake by inhalation, koteyli Turkey
H-3	1.44 E-10	2.65 E-13	3.79 E-08	6.38 E-13
C-14	7.53 E+03	7.85 E-17	1.37 E-05	1.88 E-16
MN-54	1.61 E-08	5.84 E-11	8.81 E-08	2.34 E-11
FE-55	3.96 E-07	6.43 E-10	1.41 E-05	3.09 E-10
CO-60	2.00 E-06	4.93 E-09	4.28 E-05	2.41 E-09
NI-63	2.27 E-07	1.87 E-10	5.44 E-06	7.84 E-11
ZN-65	1.58 E-08	1.86 E-11	9.09 E-07	1.23 E-11
KR-85	1.38 E-06	0.00	1.71 E-07	0.00
SR-90	3.97 E-08	2.61 E-11	1.52 E-07	1.61 E-11
TC-99	2.75 E+05	1.66 E-15	8.51 E+06	3.97 E-15
CD-109	1.11 E-11	3.81 E-14	1.31 E-10	3.76 E-14
SB-125	8.75 E-12	2.50 E-14	1.11 E-10	1.26 E-14
CS-134	1.85 E-07	4.44 E-10	3.50 E-06	1.64 E-10
CS-137	2.52 E-06	5.52 E-09	4.54 E-05	2.05 E-09
CE-141	4.08 E-13	2.95 E-15	2.13 E-12	1.10 E-15
CE-144	4.92 E-13	3.85 E-15	2.54 E-12	1.42 E-15
PM-147	5.76 E-10	1.78 E-12	6.57 E-09	8.39 E-13
RE-187	1.26 E-11	7.01 E-15	1.29 E-09	7.25 E-15
PB-210	1.17 E-10	4.03 E-13	4.59 E-10	1.53 E-13
RA-226	1.05 E-11	1.08 E-14	2.59 E-10	4.38 E-15
TH-232	8.44 E-12	2.88 E-14	3.19 E-11	1.06 E-14
U-234	1.12 E-11	3.85 E-14	7.11 E-11	2.03 E-14
U-235	1.31 E-11	4.49 E-14	7.18 E-11	2.37 E-14
U-236	1.88 E-12	6.42 E-15	1.02 E-11	3.39 E-15
U-238	1.87 E-12	6.42 E-15	6.32 E-08	2.10 E-11
PU-238	1.42 E-12	3.95 E-15	1.69 E-11	1.47 E-15
PU-239	7.41 E-13	2.01 E-15	9.-2 E-12	7.79 E-16

The PRESTO - II methodology will be used to obtain a preliminary estimate of maximum doses for selected release and exposure scenarios associated with the proposed shallow land disposal areas in Turkey (9-10). Cumulative doses and health risks are calculated for individuals and exposed populations. It will also be used to identify nuclides and scenarios that must be considered more carefully.

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