RADIOLOGICAL DOSE ASSESSMENT

Each year the potential radiological dose to the public from the West Valley Demonstration Project is assessed to determine if an individual could possibly have received an exposure exceeding the limits established by the regulatory agencies. The results of these conservative dose calculations demonstrate that the potential maximum dose to an off-site resident is well below permissible standards and is consistent with the as low as reasonably achievable philosophy of radiation protection.

Introduction

This chapter describes the methods used to estimate dose to the general public resulting from exposure to radionuclides released by the Project to the surrounding environment during 1993.

Estimated doses are compared directly to current radiation standards established by the Department of Energy (DOE) and the Environmental Protection Agency (EPA) for protection of the public. Doses are also compared to the dose the public receives from natural background radiation and to doses reported in previous years for the Project.

Radioactivity

Atoms that emit radiation are called radionuclides. Radionuclides are unstable isotopes that have the same number of protons and electrons as any other isotope of the element but different numbers of neutrons, resulting in different atomic masses. For example, the element hydrogen has two stable isotopes, H-1 and H-2 (deuterium), and one radioactive isotope, H-3 (tritium). The numbers following the element's symbol identify the atomic mass, which is the number of protons plus neutrons in the nucleus.

Once a radioactive atom decays by emitting radiation, the resulting daughter atom also may be either radioactive or stable. Each radioactive isotope has a unique half-life that represents the time it takes for 50% of the atoms to decay. Strontium-90 and cesium-137 have half-lives of about thirty years, while plutonium-239 has a half-life of 24,000 years. Emitted radiation may consist of electromagnetic rays such as x-rays and gamma rays or alpha or beta particles. Each radionuclide may emit one or more of these radiations at characteristic energies that can be used to identify them.

Radiation Dose

The energy released from a radionuclide is eventually deposited in matter encountered along the path of radiation, resulting in a radiation dose to the absorbing material. The absorbing material can be either inanimate matter or living tissue. Alpha particles leave a dense track of ionization as they travel through tissue and thus deliver the most dose per unit mass. However, alpha particles are not penetrating and must be taken into the body by inhalation or ingestion to cause harm. Beta and gamma radiation can penetrate the protective skin layer of the body from the outside to deliver a whole body dose or expose internal organs. However, beta and gamma radiation deposit much less energy in tissue per unit mass relative to alpha radiation.

Units of Measurement

The U.S. unit of measurement for dose equivalent is the rem. The international unit of measurement of dose equivalent is the sievert (Sv), which is equal to 100 rem. The millirem (mrem) and millisievert (mSv), used more frequently to report the low dose equivalents encountered in environmental exposures, are the equivalent of one-thousandth of a rem or sievert. The dose equivalent concept was developed by the radiation community to allow comparison of dose from different types of radiation.

The effective dose equivalent (EDE) was developed to account for the relative risk of radiation exposure to a particular organ or tissue. The EDE is calculated by multiplying the organ dose equivalent by the organ-weighting factors developed by the International Commission on Radiological Protection (ICRP) in Publications 26 (1977) and 30 (1979). The weighting factor is a ratio of the risk from a specific organ or tissue dose to the total risk resulting from whole body irradiation. All organ-weighted dose equivalents are then summed to obtain the EDE.

The dose from internally deposited radionuclides usually is calculated for a fifty-year period following one year of intake and is called the fifty-year committed effective dose equivalent (CEDE). The CEDE sums the dose to an individual over fifty years to account for the biological retention of radionuclides in the body. The total EDE is calculated by adding the dose equivalent from external, penetrating radiation to the CEDE. Unless otherwise specified, all doses discussed here are EDE values, which include the CEDE for internal emitters.

A collective population dose is expressed in units of person-rem or person-sievert because the individual doses are summed over the entire potentially exposed population. The average individual dose can therefore be obtained by dividing the collective dose by the number in the population.

Sources of Radiation

Members of the public are routinely exposed to different sources of ionizing radiation from both natural and manmade sources. Figure 4-1 shows the relative contribution to the annual dose in millirem (mrem) from these sources in comparison to the estimated annual dose from the WVDP. The National Council on Radiation Protection and Measurements (NCRP) Report 93 (1987) estimates that the average annual effective dose equivalent (EDE) received by an individual living in the U.S. is about 360 mrem (3.6 mSv) from both natural and manmade sources of radiation.

While most of the radiation dose affecting the general public is natural background radiation, manmade sources of radiation also contribute to the average radiation dose to individual members of the public. Such sources include diagnostic and

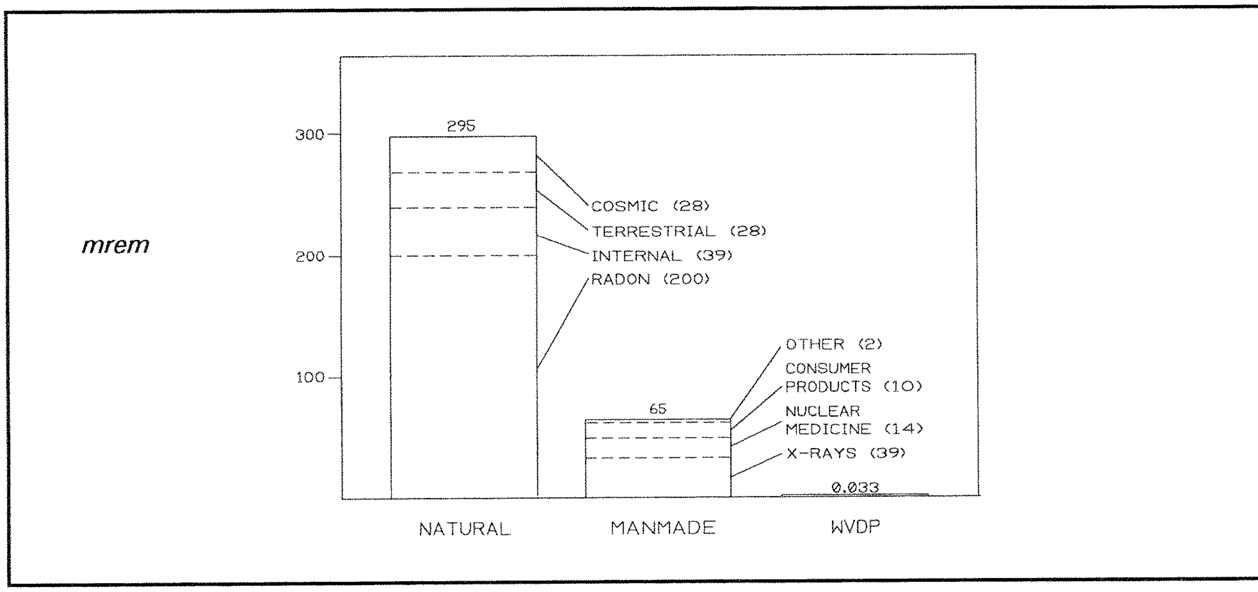


Figure 4-1. Comparison of Annual Background Radiation Dose to the Dose from 1993 WVDP Effluents

therapeutic x-rays, nuclear medicine, fallout from atmospheric nuclear weapons tests, effluents from nuclear fuel cycle facilities, and consumer products such as smoke detectors and cigarettes.

As can be seen in Figure 4-1, natural sources of radiation contribute 295 mrem (2.95 mSv) and manmade sources contribute 65 mrem (0.65 mSv) of the total annual dose of 360 mrem. The WVDP contributes a very small amount (0.033 mrem [0.00033 mSv] per year) to the total annual manmade radiation dose to the maximally exposed individual residing near the WVDP. This is much less than the average dose received from using consumer products.

Health Effects of Low-level Radiation

The primary effect of low levels of chronic radiation in an exposed individual is generally assumed to be an increased risk of cancer. Radionuclides entering the body through air, water, or food are usually distributed in different organs of the body. For example, isotopes of iodine concentrate in the thyroid. Strontium, plutonium, and americium isotopes concentrate in the skeleton. When inhaled, uranium and plutonium isotopes remain in the lungs for a long period of time. Some radionuclides such as tritium, carbon-14, or cesium-137 are distributed uniformly throughout the body. Therefore, depending on the radionuclide, some organs may receive quite different doses. Moreover, at the same dose levels, certain organs (such as the breast) are more prone to developing a fatal cancer than other organs (such as the thyroid).

Because of the uncertainty and difficulty in measuring increased cancer resulting from exposure to ionizing radiation, to be conservative, a linear model is used to predict health effects from low levels of radiation. This model assumes that there is an effect on the exposed person at all dose levels even though the body may effectively repair damage incurred from low levels of beta and gamma radiations.

Exposure Pathways

The radionuclides present at the West Valley Demonstration Project site are left over from the reprocessing of commercial nuclear fuel during the 1960s and early 1970s. A very small fraction of these radionuclides is released off-site annually through ventilation systems and liquid discharges. An even smaller fraction actually contributes to the radiation dose to the surrounding population through exposure pathways.

An exposure pathway consists of a source of contamination or radiation that is transported by environmental media to a receptor location where exposure to contaminants may occur. For example, a member of the public could potentially be exposed to low levels of radioactive particulates carried by prevailing winds.

The potential pathways of exposure to Project emissions are inhalation of gases and particulates, ingestion of local food products, ingestion of fish, beef, and deer tissues, and exposure to external penetrating radiations emanating from contaminated materials. The drinking water pathway was excluded based on usage surveys of the local population surrounding and residing downstream of the WVDP site. Table 4-1 summarizes the potential exposure pathways for the general off-site population.

Dose Assessment Methodology

The general dose assessment methodology was to first assess radionuclide concentrations measured in environmental media to ascertain if any detectable effects from WVDP activities and releases have occurred. Even if the assessment of environmental media concentrations determined that there were no effects, airborne and waterborne releases from the WVDP were modeled to estimate annual doses to individuals and the local population. This two-tiered approach to assessing potential effects and doses resulting from WVDP emissions ensures that a complete evaluation is conducted. This general methodology also allows the collective annual dose to the local population to be calculated.

Predictive Computer Modeling

Because of the difficulty of measuring the small amounts of radionuclides emitted from the site beyond those that occur naturally in the environment, computer codes were used to model the environmental dispersion of radionuclides emitted from on-site monitored ventilation stacks and liquid discharge points. The EDE to the maximally exposed off-site individual and the collective EDE to the population were calculated. These models have been approved by the Department of Energy and the Environmental Protection Agency to demonstrate compliance with radiation standards.

Radiological dose was evaluated for the three major exposure pathways: external irradiation, inhalation, and ingestion of local food products. The dose contributions from each radionuclide and pathway combination were then summed to obtain the reported total dose estimates.

Environmental Media Concentrations

Near-site and control samples of fish, milk, beef, venison, and local produce were collected and analyzed for various radionuclides, including tritium, cobalt-60, strontium-90, iodine-129, cesium-134, and cesium-137. The measured radionuclide concentrations reported in *Appendix C-3*, Tables C-3.1 through C-3.4 are the basis for comparing near-site and background concentrations.

If statistically significant differences were found between near-site and background sample concentrations, the excess near-site sample concentration was used to conduct further dose assessment. If no significant difference in concentrations was found, then it was concluded that there was no impact from site operations and further dose assessment was not conducted.

The dose to nearby residents from the consumption of foods with radionuclide concentrations

Table 4-1

Potential Exposure Pathways under Existing WVDP Conditions

Potentially Exposed Populations	Exposure Pathway and Transporting Medium	Reason for Inclusion/Exclusion
Current off-site residents	*Inhalation: gases and particulates from air*	*Off-site transport of contaminants from WVDP stacks or resuspended particulates from soils*
	Ingestion: cultivated crops	*Local agricultural products irrigated with contaminated ground- or surface water; foliar deposition and uptake of airborne contaminants*
	Ingestion: surface and groundwater	*No documented use of local surface water and downgradient groundwater wells by local residents*
	Ingestion: fish, beef, venison, and milk	*Fish exposed to contaminants in water or sediments may be consumed; beef, venison, and milk consumption following deposition of transported airborne contaminants and surface waters*
	External exposure: radiation emanating from particulates and gases from air or surface water	*Transport of air particulates and gases to off-site receptors; transport of contaminants in surface water and direct exposure during stream use and swimming*

above background concentrations was calculated by multiplying the excess concentrations by the maximum adult annual consumption rate for each type of food and the unit dose conversion factor for ingestion of the measured radionuclide. The consumption rates are based on site-specific data and recommendations in NRC Regulatory Guide 1.109 for terrestrial food chain dose assessments (U.S. Nuclear Regulatory Commission 1977). The internal dose conversion factors were obtained from Internal Dose Conversion Factors for Calculation of Dose to the Public (U.S. Department of Energy 1988).

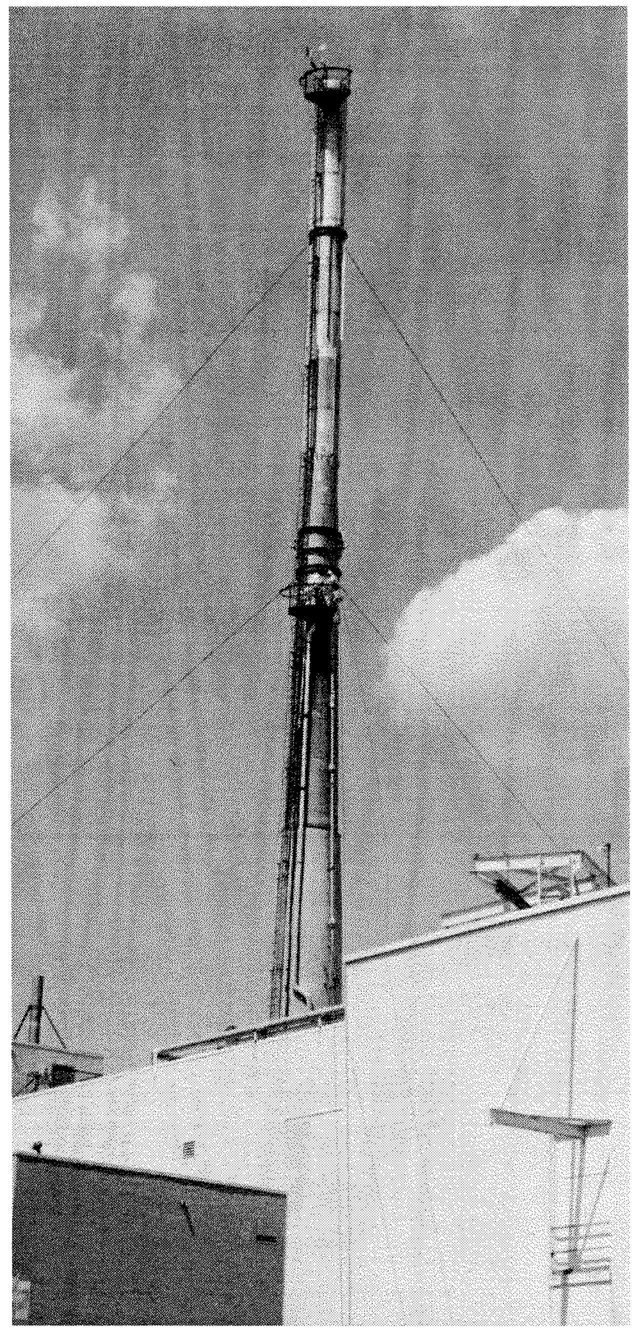
Airborne Releases

Releases of airborne radioactive materials from nominal 10-meter stacks and from the main 60-meter stack were modeled using the EPA-approved CAP88-PC computer code. This air dispersion code estimates effective dose equivalents for the ingestion, inhalation, air immersion, and ground surface pathways. Site-specific data for radionuclide release rates in curies per year, wind data, and the current local population were used as input parameters. Resulting output from the CAP88-PC code was then used to determine the total EDE to a maximally exposed individual and the collective dose to the local population within an 80-kilometer (50-mile) radius of the WVDP.

As reported in *Chapter 2, Environmental Monitoring*, five 10-meter stacks were monitored for radioactive air emissions during 1993. The activity that was released to the atmosphere from these stacks is listed in Tables C-2.1 through C-2.11 in *Appendix C-2* and was used as input to the CAP88-PC code.

The main plant stack, which vents to the atmosphere at a height of 63 meters (208 ft), was considered an elevated release; all other releases were considered ground-level releases.

Wind data collected from the on-site meteorological tower during 1993 were used as input to the CAP88-PC code. Data collected at the 60-meter and 10-meter heights were used in combination with elevated and ground-level effluent release data, respectively.



The Main Plant Ventilation Stack at the West Valley Demonstration Project

Waterborne Releases

The EDE to the maximally exposed off-site individual and the collective EDE to the population due to routine waterborne releases and natural drainage are calculated using dose conversion factors as reported in Radiological Parameters for Assessment of WVDP Activities (Faillace and Prowse 1990). Since the effluents eventually reach Cattaraugus Creek, which is not used as a source of drinking water, the most important individual exposure pathway is the consumption of fish by local sportsmen. It is assumed that a person may consume as much as 21 kilograms (46 lbs) of fish caught in the creek. Exposure to external radiation from shoreline or water contamination also is included in the model for estimating radiation dose. Population dose estimates assumed that radionuclides were further diluted in Lake Erie before reaching municipal drinking water supplies to be being ingested by the local population. The computer code LADTAP II (Simpson and McGill 1980) was used to calculate the dose conversion factors for routine waterborne releases and dispersion of these effluents. Input data included site-specific stream flow and dilution, drinking water usage, and stream usage factors. A detailed description of LADTAP II is given in Radiological Parameters for Assessment of WVDP Activities (Faillace and Prowse 1990).

Seven planned batch releases of liquid radioactive effluents from lagoon 3 occurred during 1993. The radioactivity that was discharged in these effluents is listed in *Appendix C-1*, Table C-1.1, and was used with the dose conversion factors to calculate the EDE to the maximally exposed off-site individual and the collective EDE to the population.

In addition to the batch releases from lagoon 3 (WNSP001), effluents from the sewage treatment facility (WNSP007) and the french drain (WNSP008) are routinely released. The activities measured from these release points were included in the EDE calculations. The measured radioactivities from the sewage treatment facility and french drain are presented in *Appendix C-1*, Table C-1.21 and Table C-1.26.

In addition to the above discharges there are two natural streams originating on the Project premises for which there are measurable amounts of radioactivity. These are drainages from the north swamp (WNSW74A) and northeast swamp (WNSWAMP). The measured radioactivity from these points is reported in *Appendix C-1* (Tables C-1.12 through C-1.15). These release points are included in the EDE calculations for the maximally exposed off-site individual and the collective population.

Biological Compartment Concentrations

Radionuclide concentrations in samples of fish, milk, beef, venison, and local crops were assessed to determine if near-site concentrations were significantly above concentrations for corresponding background samples.

Fish

Muscle tissue from fish collected from June 1993 through October 1993 in Cattaraugus Creek upstream (background samples) and downstream of the site above and below the Springville dam was analyzed. Ten tissue samples were collected at each of the three locations and analyzed primarily for strontium-90 and gamma-emitting radionuclides. (See Table C-3.4.) Average radionuclide concentrations from samples downstream of the site were found to be statistically indistinguishable from average background concentrations at the 95% confidence levels.

Milk

Milk samples were collected from various nearby dairy farms throughout 1993. Control samples were collected from farms 25-30 kilometers (15-20 mi) to the south and north of the WVDP. Milk samples were measured primarily for tritium, strontium-90, iodine-129, cesium-134, cesium-137, and other detectable gamma-emitting radionuclides. (See Table C-3.1.) Ten near-site milk samples were collected and compared with eight background samples. Radionuclide concentrations in routine milk samples from near-site locations were not significantly different from background concentrations except for strontium-90. Comparisons of annual average near-site to background milk showed a small net difference. This apparent difference in strontium-90 concentrations was used to project a hypothetical maximum dose of 0.02 mrem to an individual who consumed 310 liters of milk at this net concentration.

Beef

Near-site and control samples of locally raised beef were collected in 1993. These samples were measured for tritium, strontium-90, cesium-134, cesium-137, and detectable gamma-emitting radionuclides. Two samples of beef muscle tissue were collected from background locations and two from near-site locations. All individual concentrations of tritium and cesium-134 were below detection limits in background and near-site samples. Strontium-90 and cesium-137 concentrations were above detection limits, but cesium-137 was not statistically different from the background samples. (See Table C-3.2.) Although a very slight difference was postulated based on a single strontium-90 measurement, a hypothetical dose of 0.03 mrem was calculated for an individual who consumed 110 kilograms (240 lbs) of meat from this animal.

Venison

Meat samples from three near-site and three control deer were collected in 1993. (See Table C-3.2.) These samples were measured for tritium, strontium-90, cesium-134, cesium-137, and other gamma-emitting radionuclides. Cesium-134 concentrations were below detection limits in background and near-site samples. Tritium, strontium-90, and cesium-137 were detectable, but average concentrations for background and near-site samples were statistically identical.

Produce (hay, corn, beans, and apples)

Near-site and background samples of hay, corn, beans, and apples were collected during 1993 and analyzed for tritium, strontium-90, cesium-134, cesium-137, and other detectable gamma-emitting radionuclides. (See Table C-3.3.) Single samples of each type of produce were collected and compared with single background sample results. Tritium, cesium-134, and cesium-137 were all below detection limits or statistically the same as background concentrations. Strontium-90 concentrations were found to be higher in the near-site sample of hay than in the background samples of hay.

To further assess strontium-90 concentrations in hay, individual concentrations for near-site and background samples from 1987 through 1993 were statistically compared using conventional one-way analysis of variance. In addition, since the distributional nature of the data was not known, a Mann-Whitney rank sum nonparametric test was performed. The analysis of variance showed average strontium-90 from near-site and controls to be identical at the 95% level of confidence. The rank sum nonparametric test showed similar results, indicating no significant difference between average strontium-90 concentrations for hay collected in 1993 and background and near-site locations.

Predicted Dose from Airborne Emissions

Applicable Standards

Airborne emissions of radionuclides are regulated by the EPA under the Clean Air Act. Department of Energy facilities are subject to 40 CFR 61, subpart H, National Emission Standards for Hazardous Air Pollutants (NESHAP). The applicable standard for radionuclides is a maximum of 10 mrem (0.10 mSv) EDE to any member of the public in any year.

Maximum Dose to an Off-site Resident

Based on the airborne radioactivity released from the permitted point sources at the site during 1993, it was estimated that a person living in the vicinity of the WVDP could have received a total EDE of 1.6E-04 mrem (1.6E-06 mSv). This hypothetical maximally exposed individual was assumed to reside continuously 1.4 kilometers northwest of the site and to eat only locally produced foods. Approximately 86% and 71% of the estimated total dose from 1993 airborne emissions were due to iodine-129 from the 60-meter and 10-meter stacks, respectively.

The maximum potential total dose to an off-site resident was also assessed by individual exposure pathways. Ingestion accounted for 86% and 76%, inhalation for 10% and 19%, and external exposures for 4% and 5% of the total calculated doses from the 60-meter and 10-meter stacks, respectively.

The maximum total EDE of 1.6E-04 mrem (1.6E-06 mSv) from the permitted stacks and vents is far below measurable levels. This dose is comparable to much less than one minute of natural background radiation received by an average member of the U.S. population and is well below the 10 mrem (1.0E-01 mSv) NESHAP standard promulgated by the EPA.

For the purpose of demonstrating compliance with the NESHAP regulations, a less realistic but more conservative assessment also was conducted. In this case, effluent samples that were below the detection limit were assumed equal to the limit, thus giving an overestimate of the release. Using this conservative approach and including releases from three non-permitted point sources would increase the 1993 EDE to the maximally exposed off-site individual by 25%, to 2.0E-04 mrem (2.0E-06 mSv).

Collective Population Dose

The CAP88-PC version of AIRDOS-EPA was used to estimate the collective EDE to the population. According to census projections for 1992, an estimated 1.7 million people resided within 80 kilometers (50 mi) of the WVDP. This population received an estimated 1.9E-03 person-rem (1.9E-05 person-Sv) total EDE from radioactive airborne effluents released from the permitted WVDP point sources during 1993. The resulting average EDE per individual was 1.1E-06 mrem (1.1E-08 mSv).

There are no standards limiting the collective EDE to the population. However, the calculated average individual EDE is orders of magnitude lower than the 300 mrem (3 mSv) that an average member of the U.S. population receives in one year from natural background radiation. Using the more conservative approach outlined above and including the non-permitted point sources would increase the collective EDE to 2.7E-03 person-rem (2.7E-05 person-Sv).

Predicted Dose from Waterborne Releases

Applicable Standards

Currently there are no EPA standards establishing limits on the radiation dose to members of the public from liquid effluents

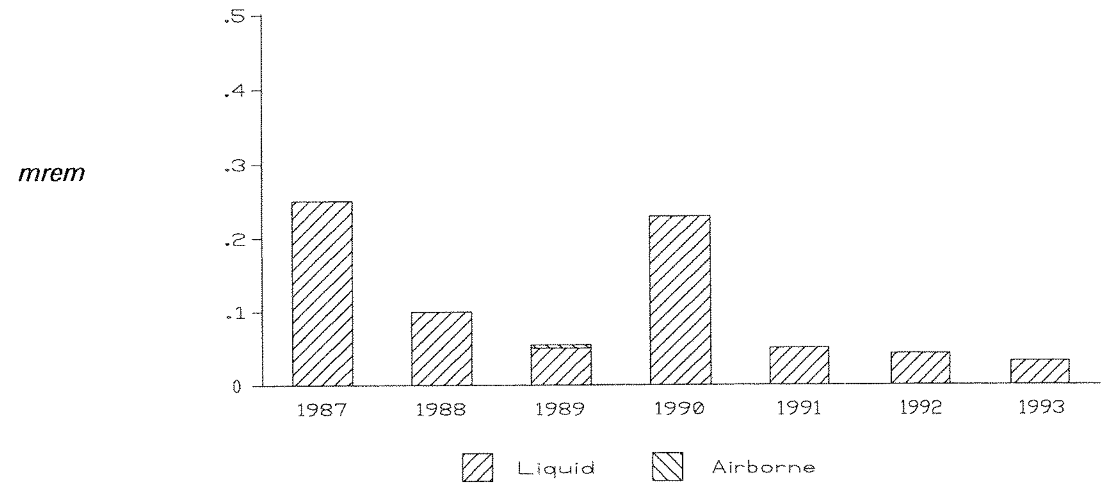


Figure 4-2. Effective Dose Equivalent from Liquid and Airborne Effluents to a Maximally Exposed Individual Residing near the WVDP

except as applied in 40 CFR 141 and 40 CFR 143, Drinking Water Guidelines (U.S. Environmental Protection Agency 1984 a,b). The potable water wells sampled for radionuclides are upgradient of the West Valley Demonstration Project and therefore are not a potential source of radiation exposure from Project activities. Since Cattaraugus Creek is not used as a drinking water supply, a comparison of the predicted concentrations and doses to the EPA standard is not relevant (although the EPA limits are easily met in creek sample values). The estimated radiation dose was compared with the applicable guidelines provided in DOE Order 5400.5.

Maximum Dose to an Off-site Individual

Based on the radioactivity in effluents released from the WVDP (lagoon 3, sewage treatment plant, and french drain) during 1993, an off-site individual could have received a potential maximum EDE of 1.1E-02 mrem (1.1E-04 mSv). Approximately 48% of this dose is from cesium-137 and 26% from strontium-90. This dose is about 27,000 times lower than the 300 mrem (3 mSv) that an average member of the U.S. population receives in one year from natural background radiation. The maximum individual EDE due to natural drainage from the north plateau (north swamp and northeast swamp) is 2.2E-02 mrem (2.2E-04 mSv). Approximately 48% of the dose is due to carbon-14. It should be noted that this relatively large carbon-14 contribution to the maximum predicted EDE is based on a single measurement in the first quarter of 1993. Subsequent measurements in the last three quarters gave values roughly 200 times less. (See Table C-1.15.) The combined EDE to the maximally exposed individual from liquid effluent is 3.3E-02 mrem (3.3E-04 mSv). This dose is about 9,000 times lower than that of the 300 mrem (3 mSv) that an average member of the U.S. population receives in one year from natural background radiation.

Collective Dose to the Population

As a result of radioactivity released in liquid effluents from the WVDP (lagoon 3, sewage treatment plant, and french drain) during 1993, the population living within 80 kilometers (50 mi)

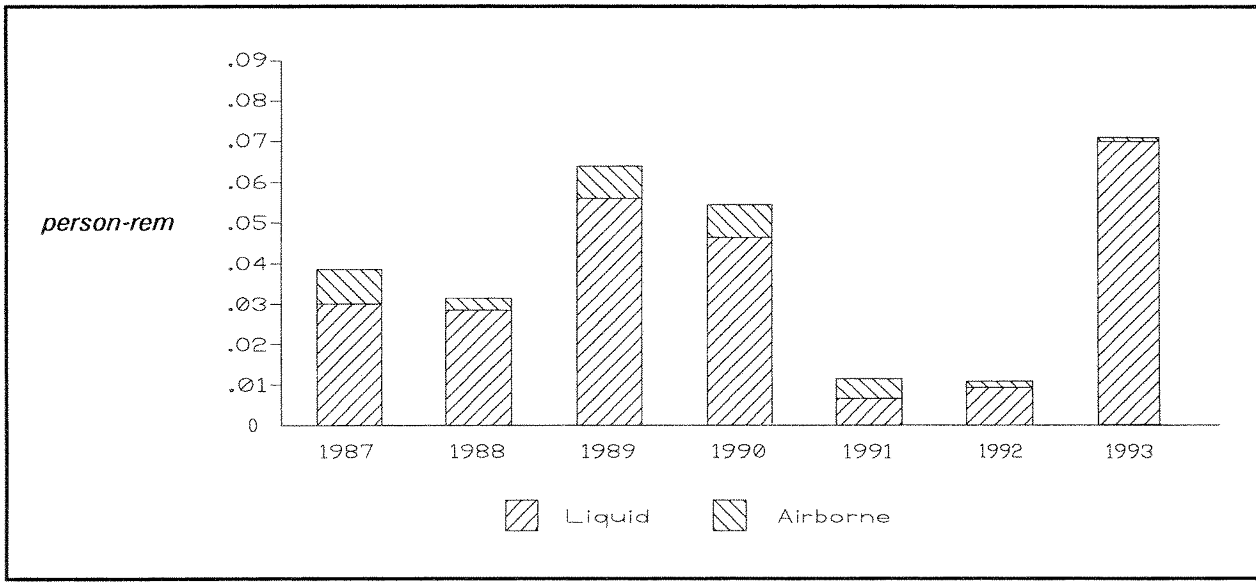


Figure 4-3. Collective Effective Dose Equivalent from Liquid and Airborne Effluents to the Population Residing within 80 Kilometers of the WVDP

of the site received a collective EDE of 2.7E-02 person-rem (2.7E-04 person-Sv). The collective dose to the population from the natural outfalls (north swamp and northeast swamp) is 4.2E-02 person-rem (4.2E-04 person-Sv). This estimate is based on a population of 1.7 million living within the 80-kilometer radius. The resulting average EDE from the lagoon 3, sewage treatment plant, french drain, and north plateau drainage (north swamp and northeast swamp) per individual is 4.1E-05 mrem (4.1E-07 mSv), or approximately 7 million times lower than the 300 mrem (3 mSv) that an average person receives in one year from natural background radiation.

Predicted Dose from all Pathways

The potential dose to the public from both airborne and liquid effluents released from the Project during 1993 is the sum of the individual dose contributions. The hypothetical maximum EDE from all pathways to a nearby resident was 3.3E-02 mrem (3.3E-04 mSv). This dose is 0.03% of the 100 mrem (1 mSv) annual limit in DOE Order 5400.5.

The total collective EDE to the population within 80 kilometers (50 mi) of the site was 7.0E-02 person-rem (7.0E-04 person-Sv), with an average EDE of 4.1E-05 mrem (4.1E-07 mSv) per individual.

Table 4-2 summarizes the dose contributions from all pathways and compares the individual doses to the applicable standards.

Figure 4-2 shows the dose to the maximally exposed individual over the last seven years. The estimated dose for 1993 is lower than the dose reported in previous years.

Figure 4-3 shows the collective dose to the population over the last seven years. The increase in the collective population dose is due primarily to the increased concentration of radionuclides in the lagoon 3 discharges and to the inclusion of the surface drainage from the north plateau in the dose estimates for the first time.

Table 4-2

Summary of Annual Effective Dose Equivalents to an Individual and Population from WVDP Effluents in 1993

Exposure Pathway	*Annual Effective Dose Equivalent*	
	Maximum Individual [1] *mrem (mSv)*	*Collective* [2] *person-rem (person-Sv)*
Airborne Releases [3]	*1.6E-04 (1.6E-06)*	*1.9E-03 (1.9E-05)*
% EPA Standard (10 mrem)	*1.6E-03*	*N/A*
Waterborne Releases [4]	*1.1E-02 (1.1E-04)*	*2.7E-02 (2.7E-04)*
Total, Including North Plateau Drainage	*3.3E-02 (3.3E-04)*	*7.0E-02 (7.0E-04)*
% DOE Standard (100 mrem)	*3.3E-02*	*N/A*
% Natural Background (300 mrem; 510,000 person-rem)	*1.1E-02*	*1.4E-05*

[1] *Maximally exposed individual at a residence 1.4 kilometers northwest from the main plant.*

[2] *Population of 1.7 million within 80 kilometers of the site.*

[3] *From calculated permitted point sources using AIRDOS-EPA (CAP88-PC for individual and population).*

[4] *Calculated using methodology described in Radiological Parameters for Assessment of WVDP Activities (Faillace and Prowse 1990).*

Exponents are expressed as "E" in this report; a value given as 1.2×10^{-4} in scientific notation is reported as 1.2E-04 in the text and tables.

N/A - Not applicable.

Risk Assessment

Estimates of cancer risk from ionizing radiation have recently been presented by the International Commission on Radiological Protection (1990), the National Council on Radiation Protection and Measurement (1987), and the National Research Council Committee on Biological Effects of Ionizing Radiation (1990). These reports estimate that the probability of fatal cancer induction to the public of all ages ranges from 1 to 5E-04 cancer fatalities/rem. The most recent risk coefficient by the International Commission on Radiological Protection of 5E-04 was used to estimate risk to a maximally exposed off-site individual. The resulting risk to this hypothetical individual from airborne and waterborne releases was a 2.0E-08 probability of a cancer fatality (1 chance in 50 million). This risk is well below the range of 1E-06 to 1E-05 per year considered acceptable by the International Commission on Radiological Protection Report 26 (1977) for any individual member of the public.

Summary

Radionuclide concentrations in biological samples (fish, milk, beef, venison, and local produce) were determined to be below detectable levels or statistically identical to background concentrations. Thus, no specific dose assessment was performed using environmental media concentrations. Predictive computer modeling was performed for airborne and waterborne releases. This analysis resulted in doses to the hypothetical maximally exposed individual that were orders of magnitude below all applicable EPA standards and DOE Orders, which limit the release of radioactive materials and dose to individual members of the public. The collective population dose was also assessed and found to be orders of magnitude below natural background radiation doses. Based on the dose assessment, the West Valley Demonstration Project was found to be in compliance with all applicable radiological guidelines and standards during 1993.