Population Array and
Agricultural Data Arrays for the
Los Alamos National Laboratory

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Los Alamos, New Mexico 87545

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Abstract

To quantify or estimate the environmental and radiological impacts from man-made sources of radioactive effluents, certain dose assessment procedures were developed by various government and regulatory agencies. Some of these procedures encourage the use of computer simulations (models) to calculate air dispersion, environmental transport, and subsequent human exposure to radioactivity. Such assessment procedures are frequently used to demonstrate compliance with Department of Energy (DOE) and U. S. Environmental Protection Agency (USEPA) regulations. Knowledge of the density and distribution of the population surrounding a source is an essential component in assessing the impacts from radioactive effluents. Also, as an aid to calculating the dose to a given population, agricultural data relevant to the dose assessment procedure (or computer model) is often required. This report provides such population and agricultural data for the area surrounding Los Alamos National Laboratory.

Introduction

This report provides human population and selected agricultural data, in the form of arrays, for the area surrounding the Los Alamos National Laboratory. More specifically, these data were constructed to aid radiological dose assessments regarding actual or hypothetical emissions scenarios through the application of computer programs such as GENII (Napier, 1988) and CAP88 (USEPA, 1990).

Area of Evaluation

The area of evaluation was a circle with an 80 km (50 mi.) radius centered on TA-53-3M; this site was used since it has been the point of maximum radionuclide air-effluents (and off-site dose) for LANL. Atmospheric dispersion procedures make use of local meteorological and climatological information to calculate radionuclide diffusion and transport, concentrations, and deposition at various directions and distances from the release point. Programs such as GENII and CAP88 group or average distances and directions into sectors or cells, creating a cell receptor grid. The resolution of the receptor grid usually decreases outward from the release point, mirroring the decreasing concentration gradient (as a function of distance traveled by the effluent) calculated by the dispersion model. The population and agricultural data are presented here in a 16 sector polar-type array, with individual cell values provided for 10 radial distances (Figure 1). The 16 sector arrays are standard geographic/input format for both the GENII and CAP88 dose models. The coordinates for the center point and grid divisions are in the New Mexico State Plane (North American Datum 1927) coordinate system.
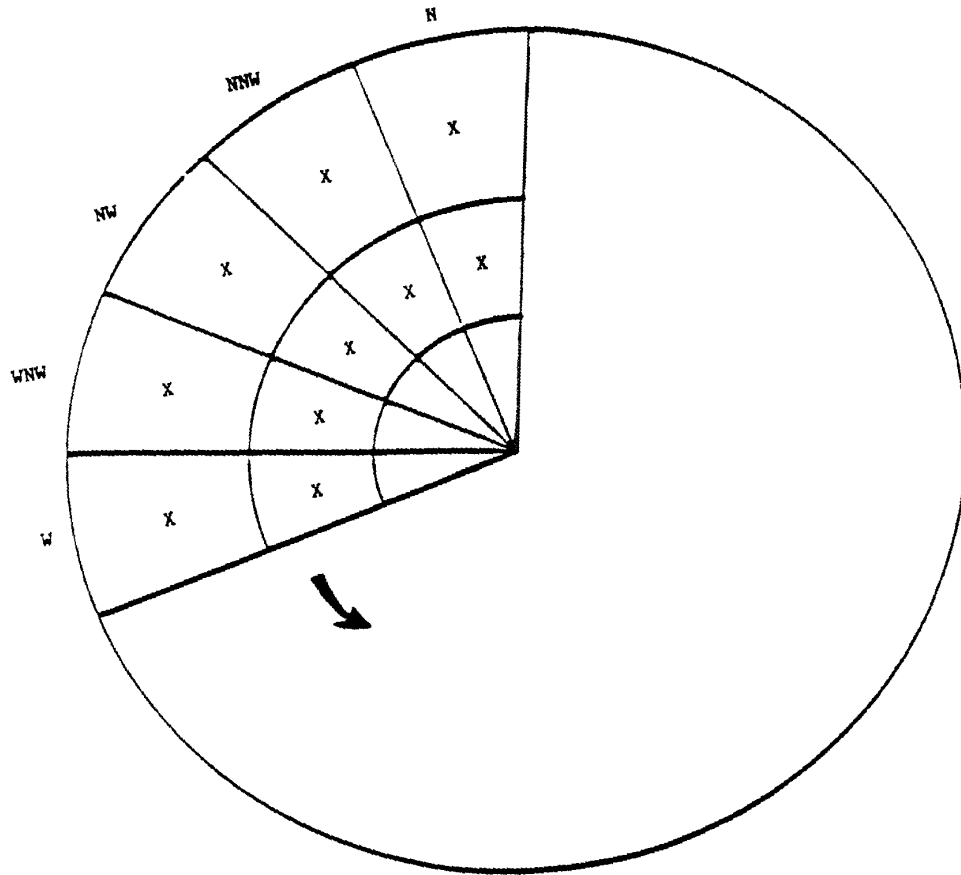
Figure 1. Polar array grid development.

The resultant assessment area included portions of Bernalillo, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, and Taos counties, and all of Los Alamos County. The area encompasses all or part of of the following Native American pueblos: Santa Clara, Picuris, San Juan, San Idefonso, Pojoaque, Nambe, Tesuque, San Filipe, Cochiti, Santo Domingo, Santa Ana, Zia, and Jemez; also, a portion of Taos Pueblo falls within the assessment area. Other significant areas of inhabitation included in the area are the townships of Santa Fe, Española, and Los Alamos. The NE sector of the polar grid reaches to the edge of the city of Taos, and the SSW sector includes a portion of Albuquerque.

Population Array Data

Population information for 10 northern NM counties was obtained via the 1990 U.S. Census TIGER[1] data. In addition to information on population, the TIGER data contains coordinates of county boundaries and land features. To estimate the changes to the population for years beyond the 1990 census, county growth factors were obtained from the New Mexico Bureau of Economic Research (derived annually for the midpoint of the current year). Once the adjustment factor was applied to the 1990 census for each county, demographic data showing the distribution and density of the population for each county was generated and plotted, and the polar grid template was overlaid to obtain the contribution from each demographic area to the individual sectors, thus creating a receptor grid. The corresponding tabular form of the data out to 80 km is provided in Table 1.

Table 1. Estimated 1995 Population within 80 km of Los Alamos National Laboratory[a]

Distances from TA-53 (km)

Direction	0-1	1-2	2-4	4-8	8-15	15-20	20-30	30-40	40-60	60-80
N	7	69	241	134	0	13	89	932	797	577
NNE	7	65	95	23	2	10	2,301	386	660	307
NE	4	11	0	0	1	1,163	14,508	2,495	2,415	3,527
ENE	1	0	0	0	550	1,468	4,480	3,525	1,392	1,564
E	0	0	0	1	311	1,310	4,034	381	21	402
ESE	0	0	0	0	9	10	658	7,890	721	2,222
SE	0	0	0	4,576	577	0	967	71,531	7,371	661
SSE	0	6	0	523	350	0	288	5,565	2,541	106
S	0	4	0	0	22	0	16	143	390	3,028
SSW	0	6	0	0	30	1	764	1,263	6,708	51,824
SW	0	13	0	0	4	1	0	0	2,158	181
WSW	0	17	0	0	7	0	29	373	2,379	4
W	0	4	121	178	0	6	64	277	59	68
WNW	2	14	1,029	5,976	0	0	25	30	61	2,519
NW	5	30	907	1,466	0	2	23	48	0	568
NNW	6	60	696	288	0	6	19	255	157	279
Total	44	289	3,116	13,166	1,863	3,990	28,265	95,094	27,830	67,837

[a]Total 1995 population within an 80-km radius of Los Alamos National Laboratory was over 241,000.

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[1] Topographically Integrated Geographic Encoding and Referencing (TIGER)

Agricultural Array Data

Agricultural data are provided on an annual basis for each county in the state by the NM Agricultural Statistics Services (NMASS). To grid or geocode the county agricultural data into polar array format, the NMASS data was augmented with information obtained through discussions and visits with NM county extension agents, National Forest Service district managers, representatives from the northern NM Indian pueblos, and representatives from other state organizations (see appendix A for list of contacts).

Tables 2 and 3 show the recent number and distribution of beef and milk cattle within an 80 km (50 mi) radius of LANL (USDA, 1994) (Radian, 1995). Since cattle occupy some grazing areas on a seasonal basis, some grid assignments were adjusted accordingly (Radian, 1995). The crops grown for consumption by cattle can be grouped under four categories: rangeland, harvestable hay, irrigated pasture land, and pasture land. Rangeland includes the uncultivated, natural grasslands of the Santa Fe and Carson National Forests, Bureau of Land Management land, etc. and includes grasses, forbs, and shrubs. Harvestable hay (and mixed hays) refers to grasses or other plants that are cut, dried, and bailed for cattle consumption. Pasture land refers to cultivated or natural grazing land (irrigated and unirrigated) maintained by a rancher. A summary of the four categories of agricultural crops grown for consumption by cattle is provided in Table 4.

Table 5 shows the amount and distribution of cultivated land surrounding LANL. The primary crops grown and consumed by the human population within the study area are apples, corn, chili, and peaches. While there are some orchards in the study area, most of the crops are produced in private gardens for personal consumption and for sale at farmers' markets (USDA 1994) (Radian 1995).

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Table 2. Estimated Number of Beef Cattle within 80 km of Los Alamos National Laboratory[a]

Distances from TA-53 (km)

Direction	0-1	1-2	2-4	4-8	8-15	15-20	20-30	30-40	40-60	60-80
N	0	0	0		14	46	121	206	772	1020
NNE	0	0	0	0	13	5	32	256	701	878
NE	0	0	0	1	11	19	5	129	234	1350
ENE	0	0	0	6	42	30	146	53	614	1348
E	0	0	0	7	38	30	149	70	251	466
ESE	0	0	0	0	0	0	134	14	146	465
SE	0	0	0	0	55	51	33	0	467	826
SSE	0	0	0	0	47	79	132	233	613	873
S	0	0	0	0	21	73	290	391	414	533
SSW	0	0	0	0	0	9	258	258	295	639
SW	0	0	0	0	21	68	78	209	391	113
WSW	0	0	0	0	16	73	197	253	652	448
W	0	0	0	0	34	97	289	294	594	781
WNW	0	0	0	0	17	103	290	289	786	2392
NW	0	0	10	0	16	57	167	179	511	895
NNW	0	0	10	0	22	50	193	62	610	1255

[a]Total estimated beef cattle within 80 km of LANL is about 29,000.

Table 3. Estimated Number of Milk Cattle within 80 km of Los Alamos National Laboratory[a]

Distances from TA-53 (km)

Direction	0-1	1-2	2-4	4-8	8-15	15-20	20-30	30-40	40-60	60-80
N	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	9	24	0	0
E	0	0	0	0	0	21	109	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0	0	0	1800
SW	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0
NW	0	0	10	0	0	0	0	0	0	0
NNW	0	0	10	0	0	0	0	0	0	0

[a]Total estimated milk cattle within 80 km of LANL is about 2,000.

Table 4. Crops Consumed by the Cattle Population within 80 km of Los Alamos National Laboratory

Primary Crop Type	Specific Grasses, Shrubs, Forbs
Rangeland	western wheat grass, festuca, needle and thread, triticali, Kentucky blue, sideoats, blue grama, black grama, blue stem, crested wheat, creosote, four-winged salt brush, broom snakeweed, and big sagebrush
Harvestable hay/mixed hay	alfalfa, sorghum
Irrigated (permanent) pasture land	timothy, alfalfa, clover, orchard grass, fescue, perennial rye grass, wheat grass
Pasture land	wheat, oats

Table 5. Estimated Cultivated Land (in km^2) within 80 km of Los Alamos National Laboratory[a]

Distances from TA-53 (km)

Direction	0-1	1-2	2-4	4-8	8-15	15-20	20-30	30-40	40-60	60-80
N	0	0	0	0	0	0	0	0.2	0.004	0
NNE	0	0	0	0	0	0	1.0	0.7	0.07	0.01
NE	0	0	0	0	0.01	0.04	0.08	0.7	1.6	1.0
ENE	0	0	0	0	0.06	0.1	2.0	2.0	0.3	0.5
E	0	0	0	0	0.06	0	0.07	0	0	0.02
ESE	0	0	0	0.0009	0.0032	0	0.2	0	0	0.02
SE	0	0	0	0.0013	0.0025	0	0.3	0.3	0	0.02
SSE	0	0	0	0	0	0	0	0.02	0.02	0.02
S	0	0	0	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0.3	0.02	0	1.1
SW	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0.0009	0.0030	0	0	0	0	0	0.2
NW	0	0	0.0009	0.0025	0	0	0	0	0.02	0
NNW	0	0	0.0009	0.0009	0	0	0	0.004	0.02	0

The total estimated cultivated land within 80 km of LANL is about 13 km^2.

References

B. A. Napier, R.A. Peloquin, D. L. Strenge, and J. V. Ramsdell, GENII-The Hanford Experimental Radiation Dosimetry Software System" (Pacific Northwest Laboratory, Hanford, Washington 1988).

U.S. Environmental Protection Agency, CAP-88 Clean Air Act Assessment Package (EPA Office of Radiation Programs, Las Vegas, Nevada, 1990).

United States Department of Agriculture (USDA), "1993 New Mexico Agricultural Statistics," USDA and New Mexico Agricultural Statistics Service Report (1994).

Radian Corporation, "Population and Agricultural Distribution Analysis for Los Alamos National Laboratory Technical Area Sites," Radian Corporation Internal Report (1995).

Appendix A

Agricultural Information Contacts List

Name	Phone #	Affiliation
Bob Pate	243-1386	Bernalillo County Extension Agent (CEA)
Skip Findley	387-2856	Mora CEA
Tony Valdez	753-3405	Rio Arriba CEA
TJ McReynolds		Eight Northern Indian Pueblos' Council
Bob Bewley	438-7481	Bureau of Land Management
George/Anthony	827-5712	State Land Office
Kay Thomas	438-7400	Bureau of Land Management
Rudy Benavidez	876-2582	Sandoval County CEA
Felix Aguilar	761-4675	Consolidated Farm Service Agency - Bernalillo
Rey Torres	758-3982	Taos CEA
Pat Torrez	471-4711	Santa Fe CEA
Pat Melendrez	454-1497	San Miguel CEA
Lee Johnson	757-6121	Pecos District SFNF
Mike Casados	454-1497	El Rito Ranger District
Sipie Maez	684-2489	Canjilon Ranger District
Erdine Talamente	759-3242	Jicarilla Apache Reservation
Ed Velarde	759-3242	Jicarilla Apache Reservation
Dale Clary	759-3242	Jicarilla Apache Reservation
Dave Manzanares	988-6993	Espanola District SFNF
Ed Romero		Soil Conservation Service
Jerry Elson	988-6940	Santa Fe Forest Service
Howard (name missing)	455-2036	Nambe Pueblo Government
Norman Steen	455-7303	Pojoaque Pueblo
Randy Sanchez	455-2031	San Ildefonso Indian Reservation
Stanley Tafoya/Dwayne Singer	753-7330	Santa Clara Indian Reservation
Lucy Aragon	289-3265	Cuba District SFNF
Tom Garrison	665-2404	EES-5/FIMAD
Belinda Sheiber	665-6780	FIMAD
Robert Martinez	638-5526	Coyote Ranger District SFNF
Jim Schibley		Ghost Ranch
Doug Bennett	662-2656	Los Alamos County Extension Services
Don Usner	351-2303	Formerly of ESH-20