Energy Technology Engineering Center
Rocketdyne Division
Rockwell International Corporation
P.O. Box 7930
Canoga Park, California 91309-7930

(818) 586-5326

Operator for
U.S. Department of Energy

Rockwell International

June 7, 1994

In reply refer to ETEC DRF-0824

R. Le Chevalier
Mail Stop T038
DOE-ETEC Site Manager
U. S. Department of Energy
Energy Technology Engineering Center
P. O. Box 7929
Canoga Park, CA 91309-7929

Subject: Final NESHAPs Report for 1993

Reference: Letter, R. Le Chevelier (DOE) to G. Gaylord (ETEC), "DOE Comments to the Draft 1993 Radioactive Emissions (NESHAPs) Report," May 31, 1994, ETEC DRF-0804.

Dear Mr. Le Chevalier:

Enclosed is the final NESHAPs Report for 1993 for the DOE facilities at SSFL. This report reflects the results of detailed analyses of effluent samples and incorporates the comments provided in your letter of May 31 (Reference).

This report includes the required Certification Statement signed by D. C. Gibbs for ETEC and yourself for the ETEC Site Office.

If you have any further questions or comments on this report, please contact Phil Rutherford, at 818/586-6140.

Very truly yours,

G. G. Gaylord

Enclosure: Radionuclide Air Emissions Annual Report
(Individual Dose from Point Sources)

DOEAIR93

U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR Part 61)
Calendar Year 1993

Site Name: Santa Susana Field Laboratory
(Prepared June 3, 1994)

Operations Office Information

Office: Oakland Operations Office
Address: 1301 Clay Street Room 700N
Oakland, CA 94612-5208

Contact: Steve Lasell Phone: 510/637-1602

Site Information

Operator: Rocketdyne Division, Rockwell International Corp.
Address: 6633 Canoga Avenue
P. O. Box 7922
Canoga Park, CA 91309-7922

Contact: P. D. Rutherford (T100) Phone: 818/586-6140

Section I. Facility Information

Site Description

The Santa Susana Field Laboratory is located in a mountainous wilderness region between the residential areas of the Simi and San Fernando Valleys, at the boundary of Ventura and Los Angeles Counties, in southern California. The site consists of approximately 2668 acres, but DOE operations are limited to a designated area of about 90 acres. The climate is generally dry, with variable winds.

The facility formerly served as a test site for very low-power experimental nuclear reactors and for developmental fuel fabrication, and fuel decladding. For the past five years, only decontamination and decommissioning operations have been performed and essentially all radioactive material, except for small amounts of residual contamination, has been removed from the site.

Source Description

Potential sources of release of radionuclides at SSFL include both point and area (non-point) sources. The point sources consist of ventilation exhaust stacks, while the area sources consist of slightly contaminated dirt areas and a water retention sump bottom. Analytical results from effluent and material sampling, identifying and quantifying radionuclides, have been used in preparing this report.

The RMDF (Radioactive Materials Disposal Facility) is used for storage of waste packages waiting shipment to a DOE waste disposal site, evaporation of radioactively contaminated water generated in decontamination operations, and decontamination, size-reduction, and packaging in support of the decontamination operations. Ventilation from work areas in this facility is exhausted through HEPA filters and released from a stack. In the NESHAPs report, this release point is identified as Source #1.

Building T059 is a former low-power reactor test facility, previously used in the development of nuclear reactors in the Systems for Nuclear Auxiliary Power (SNAP) program, where remaining activated steel and concrete structural material is being removed in a decommissioning operation. Ventilation from work areas in this facility is exhausted through HEPA filters and released from a stack. In the NESHAPs report, this release point is identified as Source #2.

Building T023 is a research laboratory in which occasional samples are analyzed for elemental content. Only very low levels of radioactivity are permitted at this lab. Process air from an inductively coupled plasma analytical unit is exhausted, without

filtration, and released from a blower under the outside roof overhang. In the NESHAPs report, this release point is identified as Source #3.

The RMDF Pond (Sump 614) is a collection sump for rainfall runoff from the RMDF. As it is dry much of the year, some sediment is subject to airborne resuspension by the wind. In the NESHAPs report, this area is identified as Source Number 1.

The RMDF North Slope is an identified area of low-level soil contamination. Radioactivity in this soil may become airborne by the wind. In the NESHAPs report, this area is identified as Source Number 2.

The T886 Sodium Disposal Facility includes approximately 3 acres of land, small portions of which are contaminated with low levels of radioactivity. It has been remediated under DOE funding and is awaiting final survey/sampling. All contaminated soil was removed and packaged for disposal, during 1993. Estimated releases are based on measured concentrations in soil and the work in progress during 1993. In the NESHAPs report, this area is identified as Source Number 3.

Section II. Air Emissions Data

Point Source	Type Control	Efficiency	Distance to Nearest Receptor
RMDF (#1)	Pre- and HEPA filters	99.995%	2320 m SSE
T059 (#2)	Pre- and HEPA filters	99.998%	2238 m SSE
T023 (#3)	none	0.0%	2290 m SSE

Point Source Radionuclides	Annual Quantity (Ci)	(Bq)
Co-60	2.7E-07	9990
Cs-137	4.7E-07	17390
U-234	2.8E-08	1036
Pu-239	6.1E-09	226
H-3	1.5E-04	5439000

Area (Non-Point) Source

RMDF Pond (Number 1)
RMDF North Slope (Number 2)
T886 Sodium Disposal Facility (Number 3)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Co-60	3.0E-07	11100
Sr-90	1.2E-06	44400
Cs-137	9.7E-06	359000
Eu-152	3.8E-08	1410
Eu-154	9.0E-09	333

Section III. Dose Assessments

Description of Dose Model

The EPA computer program CAP88-PC is used.

Dose calculations performed to demonstrate compliance with the NESHAPs standard are based on determining the maximum estimated dose to an offsite individual located at a residence, school, business or office. For this purpose, the nearest such locations have been identified by review of maps, aerial photographs, and direct observation. The locations selected are in the nearest residential area of Simi Valley, the Brandeis-Bardin Institute, the Santa Monica Mountains Conservancy Sage Ranch office, the closest residence in Black Canyon, and the closest residence in Bell Canyon. The location with the greatest estimated annual dose calculated for these locations is considered to be the location of the Maximally Exposed Individual (MEI). The dose at this location differs from the dose to the MEI selected by CAP88-PC, and printed on the CAP88-PC Synopsis Report cover sheet, since the CAP88-PC selected maximum dose is at an unoccupied location.

The most significant stack (RMDF) is used for the emission point location. Point sources are calculated in combination, and the resulting estimate of the facility Effective Dose Equivalent is compared with the NESHAPs standard to demonstrate compliance.
A dose estimate for the area sources is also calculated. The area (non-point) source contribution to the facility dose is not included in the total facility dose estimate.

Compliance Assessment

Effective Dose Equivalent: 1.1E-06 (mrem) (1.1E-11 Sv)

Location of Maximally Exposed Individual: residence in Simi Valley (2867 m NW)

This estimated dose is well below the NESHAPs standard of 10 mrem (1.0E-04 Sv).

The estimate dose due to the area (non-point) sources is 3.4E-05 mrem (3.4E-10 Sv).

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. (See, 18 U.S.C. 1001).

Date: 6/8/94

D. C. Gibbs,
ETEC General Manager
Rocketdyne Division
Rockwell International

Date: 6/8/94

for R. LeChevalier,
ETEC Site Manager
Oakland Operations Office
U. S. Department of Energy

Section IV. Additional Information

An Inductively Coupled Plasma (ICP) analytical unit was used in T023 for analysis of molten salt oxidation unit materials. An evaluation prior to use showed an expected maximum offsite dose of less than 4.5E-06 mrem/year (4.5E-11 Sv/year), with no pollution control equipment installed. This is below the threshold of 1% of the standard requiring the monitoring prescribed in 40CFR61.93(b). The dose estimated from actual operation in 1993 is 2.9E-09 mrem/year (2.9E-14 Sv/year).

There were no unplanned releases in 1993.

The maximum estimated dose due to potential releases from the area sources in 1993 is 3.4E-05 mrem/year (3.4E-10 Sv/year). Since releases from the area sources are too small and diffuse to permit accurate measurements, potential releases were estimated using the same method used in the RESRAD computer program (ANL/ES-160), for calculation of airborne radioactivity due to resuspension of soil by the wind. These estimated releases were used as input in the CAP88-PC program to perform the area source dose assessments. Releases from these sources have not been detectable by onsite continuous ambient air sampling.

Supplemental Information

The collective Effective Dose Equivalent estimated from DOE operations for 1993 is 2.4E-03 person-rem (2.4E-05 person-Sv). This was calculated by using CAP88-PC in the "POPULATION" mode with a site-specific population distribution, based on 1990 census data, supplemented by estimates of personnel onsite. The population distribution is presented in a structure utilizing 16 directions, coinciding with the wind directions, and 20 radial zones, with the distances chosen to represent the center-of-area for each zone. These zones include the population within 80 km of the site. Doses due to both point and area sources were included.

No operations are conducted that are regulated by Subparts Q and T, nor are there any emissions of Rn-220 from sources containing U-232 and Th-232. There are no non-disposal/non-storage sources of Rn-222 emission.

Based on evaluation of each source with the assumption of no pollution control equipment installed, none of the sources requires monitoring as prescribed in 40CFR61.93(b). Stack effluents at RMDF and T059 are continuously sampled, counted for gross alpha and beta activity weekly, and composited (separately) annually for detailed radiochemical analysis. Feed stock for the molten salt oxidation process is analyzed and these results are used to estimate releases from the ICP unit. Ambient air is continuously sampled on a daily basis, with weekly determination of gross alpha and beta activity, and these samples are composited (separately by location) annually for detailed radiochemical analysis. Aspects of the QA program described by Appendix B, Method 114 are implemented as appropriate for the low level of this surveillance effort.

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S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
Jun 6, 1994 11:44 am

Facility: Santa Susana Field Laboratory
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent
(mrem/year)

1.29E-06

At This Location: 2318 Meters Northwest
Source Category: DOE facility
Source Type: Stack
Emission Year: 1993

Comments: CAP88 calculation for 1993 Annual Environmental Report, combined stack sources.

Dataset Name: SSFLDOESTACK1993
Dataset Date: Jun 6, 1994 11:44 am
Wind File: WNDFILES\SSFLNRC.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 2318 Meters Northwest
Lifetime Fatal Cancer Risk: 2.81E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.27E-06
BREAST	1.14E-06
R MAR	1.15E-06
LUNGS	1.70E-06
THYROID	1.20E-06
ENDOST	3.21E-06
RMNDR	1.08E-06
EFFEC	1.29E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1993

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	2.3E-07	4.0E-08	6.8E-14	2.7E-07
CS-137	D	1.00	4.7E-07	0.0E+00	4.4E-12	4.7E-07
BA-137M	D	1.00	4.0E-07	0.0E+00	3.7E-12	4.0E-07
U-234	Y	1.00	0.0E+00	0.0E+00	2.0E-11	2.0E-11
PU-239	Y	1.00	6.1E-09	0.0E+00	0.0E+00	6.1E-09
H-3	*	0.00	1.5E-04	0.0E+00	0.0E+00	1.5E-04

SITE INFORMATION

Temperature: 17 degrees C
Precipitation: 73 cm/y
Mixing Height: 366 m

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	39.60	5.18	3.00
Diameter (m):	0.92	0.31	0.21
Plume Rise Momentum (m/s): (Exit Velocity)	9.37E+00	1.03E+01	0.00E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.076	0.000	0.008
Fraction From Assessment Area:	0.924	1.000	0.992
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

2318 2370 2867 3393 4167

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D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Jun 6, 1994 11:44 am

Facility: Santa Susana Field Laboratory
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE facility
Source Type: Stack
Emission Year: 1993

Comments: CAP88 calculation for 1993 Annual Environmental Report, combined stack sources.

Dataset Name: SSFLDOESTACK1993
Dataset Date: Jun 6, 1994 11:44 am
Wind File: WNDFILES\SSFLNRC.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.27E-06
BREAST	1.14E-06
R MAR	1.15E-06
LUNGS	1.70E-06
THYROID	1.20E-06
ENDOST	3.21E-06
RMNDR	1.08E-06
EFFEC	1.29E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	8.02E-08
INHALATION	2.04E-07
AIR IMMERSION	8.90E-11
GROUND SURFACE	1.01E-06
INTERNAL	2.84E-07
EXTERNAL	1.01E-06
TOTAL	1.29E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
CO-60	5.16E-07
CS-137	4.76E-08
BA-137M	5.17E-07
U-234	2.50E-09
PU-239	2.01E-07
H-3	5.26E-09
TOTAL	1.29E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.21E-12
BONE	2.73E-13
THYROID	5.43E-13
BREAST	4.47E-12
LUNG	6.24E-12
STOMACH	2.88E-12
BOWEL	1.44E-12
LIVER	3.54E-12
PANCREAS	1.94E-12
URINARY	1.20E-12
OTHER	2.37E-12
TOTAL	2.81E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.79E-12
INHALATION	2.15E-12
AIR IMMERSION	2.15E-15
GROUND SURFACE	2.42E-11
INTERNAL	3.93E-12
EXTERNAL	2.42E-11
TOTAL	2.81E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
CO-60	1.27E-11
CS-137	1.24E-12
BA-137M	1.24E-11
U-234	3.28E-14
PU-239	1.58E-12
H-3	1.43E-13
TOTAL	2.81E-11

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)				
Direction	2318	2370	2867	3393	4167
N	3.0E-07	3.0E-07	2.6E-07	2.4E-07	2.1E-07
NNW	8.0E-07	7.8E-07	6.7E-07	5.9E-07	4.9E-07
NW	1.3E-06	1.3E-06	1.1E-06	9.3E-07	7.7E-07
WNW	7.8E-07	7.7E-07	6.6E-07	5.8E-07	4.8E-07
W	2.6E-07	2.6E-07	2.4E-07	2.1E-07	1.9E-07
WSW	3.3E-07	3.3E-07	2.9E-07	2.6E-07	2.2E-07
SW	3.7E-07	3.6E-07	3.1E-07	2.7E-07	2.3E-07
SSW	3.4E-07	3.4E-07	2.9E-07	2.6E-07	2.2E-07
S	3.1E-07	3.1E-07	2.7E-07	2.4E-07	2.1E-07
SSE	5.9E-07	5.8E-07	4.9E-07	4.3E-07	3.6E-07
SE	8.5E-07	8.4E-07	7.1E-07	6.1E-07	5.1E-07
ESE	5.5E-07	5.4E-07	4.6E-07	4.0E-07	3.4E-07
E	2.3E-07	2.3E-07	2.1E-07	1.9E-07	1.7E-07
ENE	2.6E-07	2.5E-07	2.2E-07	2.0E-07	1.8E-07
NE	2.8E-07	2.8E-07	2.4E-07	2.2E-07	1.9E-07
NNE	2.9E-07	2.9E-07	2.5E-07	2.3E-07	2.0E-07

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Direction	Distance (m) 2318	2370	2867	3393	4167
N	6.8E-12	6.7E-12	5.8E-12	5.2E-12	4.6E-12
NNW	1.7E-11	1.7E-11	1.5E-11	1.3E-11	1.1E-11
NW	2.8E-11	2.8E-11	2.3E-11	2.0E-11	1.7E-11
WNW	1.7E-11	1.7E-11	1.4E-11	1.2E-11	1.0E-11
W	6.0E-12	5.9E-12	5.3E-12	4.8E-12	4.2E-12
WSW	7.3E-12	7.2E-12	6.3E-12	5.6E-12	4.8E-12
SW	8.1E-12	7.9E-12	6.8E-12	6.0E-12	5.1E-12
SSW	7.5E-12	7.3E-12	6.4E-12	5.6E-12	4.9E-12
S	6.9E-12	6.8E-12	6.0E-12	5.3E-12	4.6E-12
SSE	1.3E-11	1.3E-11	1.1E-11	9.3E-12	7.8E-12
SE	1.8E-11	1.8E-11	1.5E-11	1.3E-11	1.1E-11
ESE	1.2E-11	1.2E-11	1.0E-11	8.7E-12	7.3E-12
E	5.2E-12	5.1E-12	4.6E-12	4.2E-12	3.7E-12
ENE	5.7E-12	5.6E-12	5.0E-12	4.5E-12	4.0E-12
NE	6.2E-12	6.1E-12	5.4E-12	4.8E-12	4.2E-12
NNE	6.5E-12	6.4E-12	5.6E-12	5.0E-12	4.4E-12

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Version 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Population Assessment
Jun 6, 1994 11:21 am

Facility: Santa Susana Field Laboratory
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent (mrem/year)
4.14E-06

At This Location: 804 Meters Northwest
Source Category: DOE facility
Source Type: Stack
Emission Year: 1993

Comments: CAP88 calculation for 1993 Annual Environmental Report, combined stack sources.

Dataset Name: SSFLDOESTACK1993
Dataset Date: Jun 6, 1994 11:06 am
Wind File: WNDFILES\SSFLNRC.WND
Population File: POPFILES\SSFL91.POP

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 804 Meters Northwest
Lifetime Fatal Cancer Risk: 8.82E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	4.01E-06	1.97E-04
BREAST	3.57E-06	1.75E-04
R MAR	3.64E-06	1.84E-04
LUNGS	5.97E-06	3.01E-04
THYROID	3.73E-06	1.83E-04
ENDOST	1.10E-05	6.02E-04
RMNDR	3.36E-06	1.68E-04
EFFEC	4.14E-06	2.08E-04

FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	Number of People	Number of People In This Risk Range Or Higher	Deaths/Year In This Risk Range	Deaths/Year In This Risk Range Or Higher
1.0E+00 TO 1.0E-01	0	0	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0	0	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0	0	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0	0	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0	0	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	0	0	0.00E+00	0.00E+00
LESS THAN 1.0E-06	9452296	9452296	6.14E-08	6.14E-08

RADIONUCLIDE EMISSIONS DURING THE YEAR 1993

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	Source #3 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	2.3E-07	4.0E-08	6.8E-14	2.7E-07
CS-137	D	1.00	4.7E-07	0.0E+00	4.4E-12	4.7E-07
BA-137M	D	1.00	4.0E-07	0.0E+00	3.7E-12	4.0E-07
U-234	Y	1.00	0.0E+00	0.0E+00	2.0E-11	2.0E-11
PU-239	Y	1.00	6.1E-09	0.0E+00	0.0E+00	6.1E-09
H-3	*	0.00	1.5E-04	0.0E+00	0.0E+00	1.5E-04

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	73 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	39.60	5.18	3.00
Diameter (m):	0.92	0.31	0.21
Plume Rise Momentum (m/s): (Exit Velocity)	9.37E+00	1.03E+01	0.00E+00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.076	0.000	0.008
Fraction From Assessment Area:	0.924	1.000	0.992
Fraction Imported:	0.000	0.000	0.000

Beef Cattle Density:	8.81E-02
Milk Cattle Density:	2.85E-02
Land Fraction Cultivated for Vegetable Crops:	1.18E-02

POPULATION DATA

Direction	Distance (m) 804	2414	4023	5632	7242	8851	10460
N	20	0	937	7718	7403	0	0
NNW	20	0	2084	9596	6032	205	0
NW	10	0	6469	8790	10481	1695	0
WNW	10	0	0	6789	6465	2442	254
W	0	0	0	0	0	4061	1173
WSW	20	0	0	4	483	3822	688
SW	20	0	0	2792	1132	739	6224
SSW	40	0	0	0	3463	7784	6358
S	50	0	2	0	206	1172	0
SSE	20	173	350	0	1851	2295	1787
SE	30	0	1108	1411	7181	8457	9638
ESE	40	40	0	1744	8666	13984	20110
E	15	50	200	1332	3016	5725	16870
ENE	200	40	0	0	605	3329	9258
NE	50	1019	0	7142	3247	0	0
NNE	25	0	368	7010	2437	0	0

Direction	Distance (m) 12070	13679	15288	17702	20921	24140	27359
N	0	0	0	0	0	603	3
NNW	0	0	0	0	1635	0	25
NW	0	0	0	0	248	1644	11229
WNW	119	1726	12090	11775	716	1138	102
W	5955	9698	8621	7928	777	12119	11249
WSW	4207	9590	7823	14405	14554	11007	32
SW	3846	6341	6091	4101	95	1275	426
SSW	390	547	256	58	432	4758	1435
S	2652	137	0	816	3384	0	0
SSE	2249	932	705	990	3405	2753	0
SE	10936	8224	5002	4144	2861	9760	26457
ESE	25856	17396	21594	56312	27613	59748	59470
E	17877	17870	21024	63449	69399	128854	122881
ENE	8166	4495	8163	19988	22563	38060	52168
NE	0	937	0	0	11727	31265	12500
NNE	82	0	0	0	1649	1508	11866

	Distance (m)					
Direction	30577	36210	44257	52303	60350	72420
N	0	0	277	0	836	84
NNW	0	0	0	132	0	5484
NW	888	5605	19	413	0	248
WNW	305	27887	1595	12992	16770	16872
W	28461	14184	207750	43913	1217	52
WSW	1527	321	16801	0	0	2
SW	562	0	0	0	0	0
SSW	0	0	0	0	0	0
S	0	0	0	0	0	0
SSE	0	0	0	8868	49248	13112
SE	129817	322872	388476	630029	539551	830783
ESE	62668	358441	878007	705203	587799	1011657
E	97754	151766	111367	140956	79777	180797
ENE	5559	1125	1077	2326	2169	48582
NE	44283	16296	7404	4543	12320	141034
NNE	4539	2187	11	1827	860	2577