NERC-LV-539-25

REPORT OF BIOENVIRONMENTAL SAMPLING AT THE GNOME SITE, CARLSBAD, NEW MEXICO - OCTOBER 1972

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Aniaml Investigation Program
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U.S. ENVIRONMENTAL PROTECTION AGENCY
Las Vegas, Nevada

Published November 1973

This study performed under a Memorandum
of Understanding No. AT(26-1)-539
for the
U.S. ATOMIC ENERGY COMMISSION

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ABSTRACT

A bioenvironmental sampling program of the Gnome Site was conducted during October 1972, in order to document present radionuclide concentrations within plant and animal tissues, which may have resulted from the release of radioactivity during the Gnome Event of 1961 and/or from contaminated debris brought to the surface during reentry operations. Levels of event-related gamma emitting radionuclides, in the tissues of the birds and animals sampled, did not exceed the minimum detectable activities. Detectable levels of tritium were found in the flesh of all animals sampled. Zirconium-95 and ruthenium-103 were detected in certain grass samples but were thought to be the result of world-wide fallout. Strontium-90 levels in the bones and plant samples were also attributed to world-wide fallout. The data indicated no radiological hazard to man through the ingestion of tissues of wildlife that reside in the area of the Gnome Site.

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INTRODUCTION

During October 1972, the National Environmental Research Center, Las Vegas (NERC-Las Vegas) conducted a bioenvironmental sampling program at the site of the Gnome Event near Carlsbad, New Mexico, for the documentation of radionuclide concentrations in plant and animal tissues which might have resulted from radioactivity released during the Gnome Event of 1961 and/or from contaminated debris brought to the surface during subsequent reentry activities. This program was authorized by Mr. Roger Ray, Assistant Manager for Operations, Nevada Operations Office (NVOO), United States Atomic Energy Commission, in a memorandum dated October 2, 1972, to Dr. D. S. Barth, Director, NERC-Las Vegas. The memorandum requested that the field effort for this program be conducted during October 1972.

SAMPLING AND ANALYTICAL PROCEDURES

General

Through consultation with NVOO officials and the NERC-Las Vegas statistician, a sampling program was developed which, due to the short time frame requested, emphasized the collection of readily available samples in the food chain of man. The program entailed the intensive collection of two species of vegetation utilized by grazing animals and the opportunistic collection of game birds, game animals, predators and cattle feces. Areas to be sampled included the surface ground zero and salt pile area, points within the original fallout pattern at varying distances from ground zero, and a non-contaminated area upwind to serve as control area[1].

Scientific collection permits which authorized the collection of game and non-game animals and birds were obtained from the appropriate agencies of the Federal and New Mexico governments.

The area was surveyed and sampled during the week of October 8, 1972. Four sampling stations were established within the original fallout pattern at the following distances northwest of ground zero: 0.8 kilometers (0.5 miles), 3.2 kilometers (two miles), 4.8 kilometers (three miles, and 6.4 kilometers (four miles). A control station was established 3.6 kilometers (2.25 miles) southwest from ground zero. Figure 1 shows exact sampling locations.

Following collection, samples were returned to the NERC-LV for sample preparation and analysis. Samples selected for analysis for gamma emitting radionuclides were placed in 400 ml containers and counted for 100 minutes on a 4-inch by 4-inch NaI(Tl) crystal connected to 200 channels of a 400-channel pulse height analyzer calibrated at 10 keV/channel. Samples analyzed for ^{89}Sr, ^{90}Sr, and ^{239}Pu content were prepared by low temperature ashing. Plutonium was analyzed by alpha spectroscopy[2,3]. Other radionuclide analytical procedures used at the NERC-LV are described elsewhere[4].

Grasses

The area manager and area range specialist of the Bureau of Land Management participated in the survey of the site and recommended that grasses sampled should be sand dropseed (*Sporobolus cryptandrus*) and black grama (*Bouteloua eriopoda*) as both were common at all sampling sites and were favored in

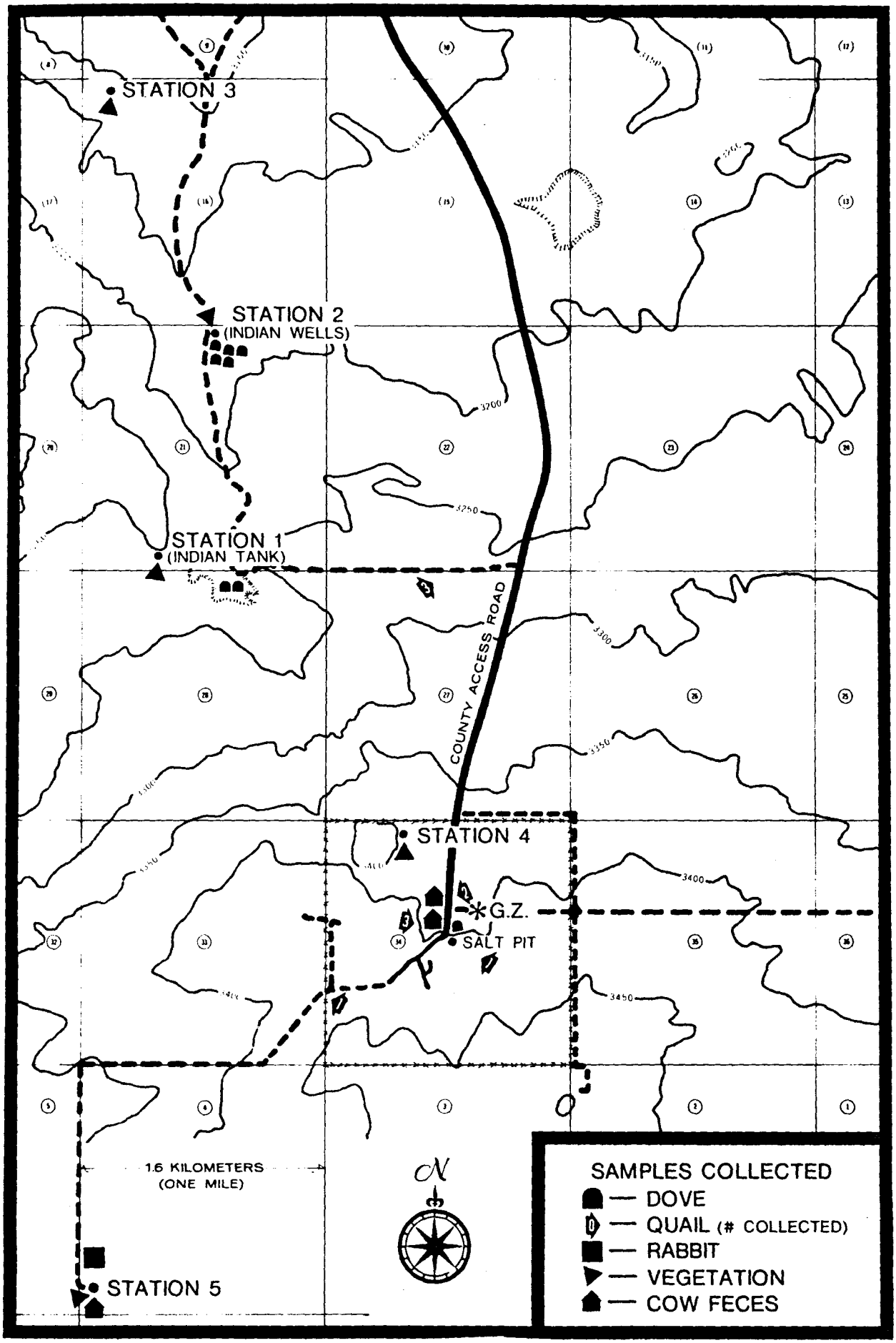

Figure 1. Location of Samples Collected at the Gnome Site.

the diet of cattle, deer, and antelope. The seeds are utilized by birds and rodents.

Five 100 to 200 gram samples of each grass species were collected at each sampling station. The grass was clipped at the five centimeter level to collect the portion removed by biting action of grazing animals. Sufficient grass samples for each station were usually found within a six-meter square (36 square meters). Each grass sample was compressed into a 400 ml container and submitted for gamma spectroscopy. Following this analysis, the five samples of each grass species from each station were composited for radiochemical analysis. Compositing was required to provide sufficient ash for strontium analysis.

Mourning Doves

Eight mourning doves (*Zenaidura macroura*) were collected by shotgun, two at a water hole near Station 1, five at a water tank at Station 2, and one near ground zero (see Figure 1). Although it is possible that these were local birds, they probably originated in a northern state and were in the area for only a few days while in transit during their fall migratory flight. These birds are primarily plant and seed eaters. Each individual whole bird was placed in a 400-ml container and was analyzed by gamma spectroscopy. The birds were then dissected and pooled samples of muscle and internal organs collected. The composited muscle and internal organ samples were again submitted for gamma analysis. The composited muscle sample was also submitted for plutonium analysis. Bone samples from each individual bird were analyzed for strontium content.

Scaled Quail

Numerous coveys of scaled quail (*Callipepla squamata*) were found on and around the site. These small birds are seed and insect eaters and spend their lives within a restricted area that seldom exceeds one mile in diameter. Ten quail were collected by shotgun. Six birds were collected within 200 meters of the salt pile, one near the west gate of the enclosed area and three approximately 1.6 kilometers (one mile) east of Station 1 (see Figure 1). Four of these birds were hatched during 1972, and the remaining six were adult birds.

The quail were sampled and analyzed in the same manner as were the doves. Following the individual whole body analysis, the muscle, the skin and feathers, and the internal organs from each of the six mature birds and from each of the four young birds were pooled and resubmitted for gamma analysis. The composited muscle samples from both the old and young birds were analyzed for tritium content. Individual bone samples were submitted for strontium analysis.

Other Samples

Few signs of rabbit habitation were noted in the sampling areas, and only one cottontail (*Sylvilagus* species) was collected. The collected rabbit was necropsied and skin, muscle, and internal organs were submitted for gamma analysis. Bone was submitted for strontium analysis and muscle for tritium analysis.

Despite intensive day and night hunting, predators were not observed or collected during the sampling period.

Samples of dried cow feces were collected from the road at the edge of the salt pile, on the road approximately 15 meters (50 feet) north of the salt pile, and at Station 5. These were submitted for gamma analysis.

RESULTS AND DISCUSSION

General

The analytical data for all samples are found in Appendix I. All data are reported at the 95% confidence level and are corrected to time of collection. The minimum detectable activities for each radionuclide are listed in Appendix II and are expressed in the data tables of this report as less than a certain level of activity present in the total sample.

Grasses

Detectable levels of ^{95}Zr and/or ^{103}Ru were found in samples of black grama grass collected from each station (see Table 1). As shown in Figure 2, this grass grows in clumps close to the ground that tend to collect drifts of sand. It was also observed that sand cast tunnels of an insect larvae frequently were attached to the plant stalks. Some of this sand may have been inadvertently incorporated into the sample and thus account for the detectable levels reported. Unfortunately, funds available for this study were limited and precluded the collection and analysis of concurrent soil samples.

Detectable levels of gamma emitting radionuclides other than the naturally occurring ^{40}K were reported in only two of the dropseed samples. Each gram of a sample from Station 1 contained 0.2 pCi of ^{103}Ru and one sample from

Table 1. Concentrations of Certain Gamma Emitting Radionuclides in Black Grama Grass Samples

Station No.	^{95}Zr pCi/g	^{103}Ru pCi/g	Remarks
1	0.65	<25	One of five samples contained detectable levels of ^{95}Zr.
2	0.23	<25	One of five samples contained detectable levels of ^{95}Zr and one contained ^{103}Ru.
	<25	0.69	
3	<25	0.19	Four of five samples contained detectable levels of ^{103}Ru.
	<25	0.40	
	<25	0.42	
	<25	0.82	
4	<25	1.1	Two of five samples contained detectable levels of ^{95}Zr and two contained ^{103}Ru.
	0.83	0.32	
	0.51	<25	
5	<25	0.35	One of five samples contained detectable levels of ^{95}Zr and one contained ^{103}Ru.
	0.82	<25	

FIGURE 2. Physical Characteristics of Black Grama Grass

Station 3 contained 0.7 pCi ^{95}Zr per gram. As this grass is more erect, it does not collect the large drifts of sand as does the black grama. Insect larvae sand cast tunnels were not observed. Hence the chance of soil contamination was reduced. Figure 3 shows the physical characteristics of this grass species.

The strontium analysis data in the composited grass samples are summarized in Table 2. Strontium-89 content was below the minimum detectable activity in all samples. The range of ^{90}Sr content in the dropseed was 1.3-2.9 pCi/g of ash and in the black grama was 1.3-4.1 pCi/g ash. The higher yield of ash from the black grama supports the hypothesis of inadvertent inclusion of sand within the sample.

Animal Tissues

Levels of gamma emitting radionuclides other than the naturally occurring ^{40}K, in the tissues collected from the doves, quail, and rabbit did not exceed the minimum detectable activities listed in Appendix II. For the dove tissues, this was not unexpected as the doves had probably been in the area for only a few days to a few weeks. However, the absence of detectable levels of gamma emitting radionuclides in the quail and rabbit tissues is of some significance as both species are nonmigratory and spend their entire life within a restricted zone.

The ^{89}Sr content of the bone ash from each of the eight doves did not exceed the minimum detectable activity. The ^{90}Sr levels ranged from

FIGURE 3. Physical Characteristics of Sand Dropseed Grass

Table 2. Concentrations of Strontium in Composited Grass Samples

Station Location	Grass Species	Wet Sample Size in Grams	Ash Percentage	^{89}Sr pCi/g/ash	^{89}Sr pCi/kg wet	^{90}Sr pCi/g ash	^{90}Sr pCi/kg wet
1	Dropseed	720	3.5	<2.2	<76	2.8±0.44	99±15
	Black Grama	651	5.7	<1.1	<60	2.7±0.4	160±23
2	Dropseed	907	3.3	<2.0	<70	2.9±0.4	95.3±14
	Black Grama	809	5.3	<2.0	<110	4.1±0.42	220±22
3	Dropseed	690	4.8	<1.4	<65	1.3±0.28	62±13
	Black Grama	1073	5.9	<1.4	<87	1.3±0.26	76±16
4	Dropseed	1153	3.8	<1.9	<75	1.9±0.35	74±13
	Black Grama	764	5.7	<2.2	<120	3.6±0.44	200±24
5	Dropseed	927	3.8	<2.0	<65	2.0±0.35	75±13
	Black Grama	866	5.8	<2.6	<150	3.3±0.5	190±29
Dropseed Range			3.3-4.8	<1.4-<2.2	<65-<76	1.3-2.9	62-99
Dropseed Median			3.8	<2.0	<70	2.0	75
Black Grama Range			5.3-5.9	<1.1-<2.6	<60-<150	1.3-4.1	76-220
Black Grama Median			5.7	<2.0	110	3.3	190

1.4-5.0 pCi/g of ash with a median of 2.35 pCi/g of ash. The plutonium levels in the composited muscle sample were less than 0.011 pCi/g of ash of ^{238}Pu and less than 0.0042 pCi/g of ash of ^{239}Pu.

Again, the ^{89}Sr content in the bones of each of the ten quail was below the minimum detectable activity. The ^{90}Sr content ranged from 1.0-7.0 pCi/g of ash with a median of 1.5 pCi/g of ash. The tritium content in the composited muscle sample from the six mature birds was 660±250 pCi/g of body water and in the four young birds was 9300±350 pCi/l of body water. The latter value is an order of magnitude higher than was expected and observed in other animal tissues from the area. It must be considered suspect and may have resulted from contamination that occurred during the sample preparation or analytical procedures.

The ^{90}Sr content of the rabbit bone was 1.8±1.0 pCi/g of ash. The tritium level in the muscle was 470±260 pCi/l of body water. The ^{90}Sr values reported from these animals are a factor of two to three lower than the levels reported from animals residing on the Nevada Test Site[5].

Cattle feces

Detectable levels of ^{137}Cs (7.1 pCi/g) and ^{95}Zr (2.9 pCi/g) were found in the dried cow feces collected near the salt pile which was known to contain ^{137}Cs[6]. The fecal sample from 15 meters (50 feet) north of the salt pile contained 0.4 pCi of ^{103}Ru per gram and 1.6 pCi of ^{95}Zr per gram. As these radionuclides may have been in the sand that had adhered to the cracks and crevices of the sample, the salt pile sample was liquified, blended and the supernatant material resubmitted for gamma analysis.

The second analysis of the salt pile sample yielded a Cs/K ratio (pCi Cs/gK) of 900, about half the ratio of 1600 derived from the first analysis. This suggests some external contamination was present in the fecal sample. The remaining ^{137}Cs activity may have been due to incomplete removal of adventitious material as the other fecal samples showed no cesium activity.

SUMMARY

The data collected indicate that there would be no significant radiological hazard to man from the ingestion of tissues of wildlife that reside within the areas possibly affected by the Gnome Event.

The gamma emitting radionuclides ^{103}Ru and ^{95}Zr detected within the grass samples have half-lives of 40 days and 65 days, respectively, and therefore it is not conceivable that they originated from the Gnome Event and most probably are a result of world-wide fallout. In any event, either of these radionuclides, when ingested by grazing animals or man, pass through the gastrointestinal tract with very little absorption.

Strontium-90 levels in the grasses and animal tissues were at the background level. Tritium concentrations in the animal tissues were also near background except for one sample in which the higher activity is ascribed to analytical error.

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APPENDIX I.

RADIONUCLIDE LEVELS IN ANIMAL AND PLANT SAMPLES FROM THE GNOME SITE* PAGE 001

NEW MEXICO REPORTED 04/30/73

	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
BLACKGRAMA-STA1-SAMPLE-1-GNOME-72	K	4.9E-03		GM/GM			
62 0226 015 30 6 57 10 30 0830							
102945 GNOME DATE- 10 12 72							
SIZE- 142 GM							
BLACKGRAMA-STA-1-SAMPLE2-GNOME-72	K	7.9E-03		GM/GM			
62 0226 015 30 6 57 10 18 1530							
102946 GNOME DATE- 10 12 72							
SIZE- 130 GM							
BLACKGRAMA-STA-1-SAMPLE-3-GNOME-72	K	2.8E-03		GM/GM			
62 0226 015 30 6 57 10 26 1630							
102947 GNOME DATE- 10 12 72							
SIZE- 130 GM							
BLACKGRAMA-STA1-SAMPLE4-GNOME-72	K	5.0E-03		GM/GM			
62 0226 015 30 6 57 10 27 1630							
102948 GNOME DATE- 10 12 72							
SIZE- 160 GM							
BLACKGRAMA-STA-1-SAMPLE5-GNOME-72	95ZR	6.5E-01		PCI/GM			
62 0226 015 30 6 57 10 30 1020	K	5.5E-03		GM/GM			
102949 GNOME DATE- 10 12 72							
SIZE- 105 GM							
DROPSEED-STA-1-SAMPLE1-GNOME-72	K	5.6E-03		GM/GM			
62 0226 015 30 6 57 10 26 1255							
102950 GNOME DATE- 10 12 72							
SIZE- 160 GM							

*NOTE: RESULTS ARE GIVEN IN EXPONENTIAL NOTATION--THE NUMBER FOLLOWING AN -E- IS THE EXPONENT OF TEN BY WHICH THE PRECEDING NUMBER SHOULD BE MULTIPLIED. <LT- INDICATES LESS THAN, -NA- INDICATES NO ANALYSIS, AND -ND- INDICATES NOT DETECTED. TWO-SIGMA VALUES ARE GIVEN IN PARENTHESES WHEN AVAILABLE.

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
DROPSEED-STA-1-SAMPLE2-GNOME-72	K	6.6E-03		GM/GM			
62 0226 015 30 6 57 10 19 1200							
102951 GNOME DATE- 10 12 72							
SIZE- 161 GM							
DROPSEED-STA-1-SAMPLE3-GNOME-72	K	6.9E-03		GM/GM			
62 0226 015 30 6 57 10 30 1020							
102952 GNOME DATE- 10 12 72							
SIZE- 121 GM							
DROPSEED-STA-1-SAMPLE-4-GNOME-72	103RU	0.2E00		PCI/GM			
62 0226 015 30 6 57 10 18 1530	K	4.4E-03		GM/GM			
102953 GNOME DATE- 10 12 72							
SIZE- 177 GM							
DROPSEED-STA-1-SAMPLE-5-GNOME-72	K	1.8E-02		GM/GM			
62 0226 015 30 6 57 10 25 1105							
102954 GNOME DATE- 10 12 72							
SIZE- 113 GM							
BLACKGRAMA-STA-2-SAMPLE1-GNOME-72	K	1.0E-02		GM/GM			
62 0226 015 30 6 57 10 25 1105							
102955 GNOME DATE- 10 12 72							
SIZE- 115 GM							
BLACKGRAMA-STA2-SAMPLE2-GNOME-72	95ZR	2.3E-01		PCI/GM			
62 0226 015 30 6 57 10 19 1500	K	1.9E-03		GM/GM			
102956 GNOME DATE- 10 12 72							
SIZE- 165 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
BLACKGRAMA-STA-2-SAMPLE-3-GNOME-72 62 0226 015 30 6 57 10 20 1030 102957 GNOME DATE- 10 12 72 SIZE- 89.6 GM	K	1.4E-02		GM/GM			
BLACKGRAMA-STA-2-SAMPLE-4-GNOME-72 62 0226 015 30 6 57 10 19 1005 102958 GNOME DATE- 10 12 72 SIZE- 181 GM	K	4.7E-03		GM/GM			
BLACKGRAMA-STA2-SAMPLE5-GNOME-72 62 0226 015 30 6 57 10 19 1120 102959 GNOME DATE- 10 12 72 SIZE- 101 GM	103RU K	6.9E-01 3.6E-03		PCI/GM GM/GM			
DROPSEED-STA-2-SAMPLE-1-GNOME-72 62 0226 015 30 6 57 10 24 1630 102960 GNOME DATE- 10 12 72 SIZE- 159 GM	K	7.1E-03		GM/GM			
DROPSEED-STA-2-SAMPLE-2-GNOME-72 62 0226 015 30 6 57 10 19 1005 102961 GNOME DATE- 10 12 72 SIZE- 158 GM	K	7.0E-03		GM/GM			
DROPSEED-STA-2-SAMPLE-3-GNOME-72 62 0226 015 30 6 57 10 30 1205 102962 GNOME DATE- 10 12 72 SIZE- 167 GM	K	6.9E-03		GM/GM			

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
DROPSEED-STA-2-SAMPLE 4-GNOME-72	K	7.1E-03		GM/GM			
62 0226 015 30 6 57 10 19 1500							
102963 GNOME DATE- 10 12 72							
SIZE- 142 GM							
DROPSEED-STA-2-SAMPLE-5-GNOME-72	K	7.4E-03		GM/GM			
62 0226 015 30 6 57 10 30 0830							
102964 GNOME DATE- 10 12 72							
SIZE- 145 GM							
DROPSEED-STA-3-SAMPLE-1-GNOME-72	K	1.1E-02		GM/GM			
62 0226 015 30 6 57 10 25 1530							
102965 GNOME DATE- 10 12 72							
SIZE- 117 GM							
BLACKGRAMA-STA-3-SAMPLE-1-GNOME-72	103RU	1.9E-01		PCI/GM			
62 0226 015 30 6 57 10 26 1255	K	6.0E-03		GM/GM			
102966 GNOME DATE- 10 12 72							
SIZE- 153 GM							
BLACKGRAMA-STA-3-SAMPLE-2-GNOME-72	103RU	0.4E00		PCI/GM			
62 0226 015 30 6 51 10 20 1020	K	4.6E-03		GM/GM			
102967 GNOME DATE- 10 12 72							
SIZE- 149 GM							
BLACKGRAMA-STA-3-SAMPLE-3-GNOME-72	103RU	4.2E-01		PCI/GM			
62 0226 015 30 6 57 10 25 1530	K	1.3E-02		GM/GM			
102968 GNOME DATE- 10 12 72							
SIZE- 121 GM							

NEW MEXICO REPORTED 04/30/73

	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
BLACKGRAMA-STA-4-SAMPLE-4-GNOME-72	K	6.6E-03		GM/GM			
62 0226 015 30 6 57 10 30 1205							
102969 GNOME DATE- 10 12 72							
SIZE- 145 GM							
BLACKGRAMA-STA-3-SAMPLE-5-GNOME-72	103RU	8.2E-01		PCI/GM			
62 0226 015 30 6 57 10 19 1200	K	6.2E-03		GM/GM			
102970 GNOME DATE- 10 12 72							
SIZE- 116 GM							
DROPSEED-STA-3-SAMPLE-2-GNOME-72	95ZR	0.7E00		PCI/GM			
62 0226 015 30 6 57 10 18 1530	K	7.8E-03		GM/GM			
102971 GNOME DATE- 10 12 72							
SIZE- 70.6 GM							
DROPSEED-STA-3-SAMPLE-3-GNOME-72	K	9.1E-03		GM/GM			
62 0226 015 30 6 57 10 19 1305							
102972 GNOME DATE- 10 12 72							
SIZE- 152 GM							
DROPSEED-STA-3-SAMPLE-4-GNOME-72	K	6.5E-03		GM/GM			
62 0226 015 30 6 57 10 26 0940							
102973 GNOME DATE- 10 12 72							
SIZE- 110 GM							
DROPSEED-STA-3-SAMPLE-5-GNOME-72	K	1.5E-02		GM/GM			
62 0226 015 30 6 57 10 25 1105							
102974 GNOME DATE- 10 12 72							
SIZE- 95.9 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
BLACKGRAMA-STA-4-SAMPLE-1-GNOME-72	K	1.1E-02		GM/GM			
62 0226 015 30 6 57 10 24 1630							
102975 GNOME DATE- 10 12 72							
SIZE- 91.6 GM							
BLACKGRAMA-STA-4-SAMPLE-2-GNOME-72	K	3.0E-03		GM/GM			
62 0226 015 30 6 57 10 19 1120							
102976 GNOME DATE- 10 12 72							
SIZE- 119 GM							
BLACKGRAMA-STA-4-SAMPLE-3-GNOME-72	103RU	1.1E00		PCI/GM			
62 0226 015 30 6 57 10 31 1630	K	4.3E-03		GM/GM			
102977 GNOME DATE- 10 12 72							
SIZE- 89.7 GM							
BLACKGRAMA-STA4-SAMPLE-4-GNOME-72	103RU	3.2E-01		PCI/GM			
62 0226 015 30 6 57 10 20 1030	95ZR	8.3E-01		PCI/GM			
102978 GNOME DATE- 10 12 72	K	1.5E-02		GM/GM			
SIZE- 121 GM							
BLACKGRAMA-STA4-SAMPLE-5-GNOME-72	95ZR	5.1E-01		PCI/GM			
62 0226 015 30 6 57 10 25 1105	K	7.8E-03		GM/GM			
102979 GNOME DATE- 10 12 72							
SIZE- 109 GM							
DROPSEED STA-4-SAMPLE-1-GNOME-72	K	7.8E-03		GM/GM			
62 0226 015 30 6 57 10 20 1020							
102980 GNOME DATE- 10 12 72							
SIZE- 129 GM							

NEW MEXICO REPORTED 04/30/73

	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
DROPSEED -STA-4-SAMPLE-2-GNOME-72	K	1.1E-02		GM/GM			
62 0226 015 30 6 57 10 18 1540							
102981 GNOME DATE- 10 12 72							
SIZE- 90.4 GM							
DROPSEED -STA-4-SAMPLE-3-GNOME-72	K	7.7E-03		GM/GM			
62 0226 015 30 6 57 11 01 0930							
102982 GNOME DATE- 10 12 72							
SIZE- 138 GM							
DROPSEED -STA-4-SAMPLE-4-GNOME-72	K	9.2E-03		GM/GM			
62 0226 015 30 6 57 10 18 1540							
102983 GNOME DATE- 10 12 72							
SIZE- 111 GM							
DPOPSEED-STA-4-SAMPLE-5-GNOME-72	K	5.8E-03		GM/GM			
62 0226 015 30 6 57 11 01 0930							
102984 GNOME DATE- 10 12 72							
SIZE- 130 GM							
BLACKGRAMA-STA5-SAMPLE-1-GNOME-72	103RU	3.5E-01		PCI/GM			
62 0226 015 30 6 57 10 25 0915	K	1.1E-02		GM/GM			
102985 GNOME DATE- 10 12 72							
SIZE- 117 GM							
BLACKGRAMA-STA5-SAMPLE-2-GNOME-72	K	3.8E-03		GM/GM			
62 0226 015 30 6 57 11 01 1120							
102986 GNOME DATE- 10 12 72							
SIZE- 132 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
BLACKGRAMA-STA5-SAMPLE-3-GNOME-72	K	3.5E-03		GM/GM			
62 0226 015 30 6 57 10 19 0920							
102987 GNOME DATE- 10 12 72							
SIZE- 87.8 GM							
BLACKGRAMA-STA-5-SAMPLE-4-GNOME-72	K	1.2E-02		GM/GM			
62 0226 015 30 6 57 10 25 0915							
102988 GNOME DATE- 10 12 72							
SIZE- 130 GM							
BLACKGRAMA-STA5-SAMPLE-5-GNOME-72	95ZR	8.2E-01		PCI/GM			
62 0226 015 30 6 57 10 25 0915	K	9.9E-03		GM/GM			
102989 GNOME DATE- 10 12 72							
SIZE- 129 GM							
DROPSEED-STA5-SAMPLE-1-72	K	5.7E-03		GM/GM			
62 0226 015 30 6 57 10 18 1530							
102990 GNOME DATE- 10 12 72							
SIZE- 126 GM							
DROPSEED-STA5-SAMPLE-2-GNOME-72	K	8.1E-03		GM/GM			
62 0226 015 30 6 57 10 26 0940							
102991 GNOME DATE- 10 12 72							
SIZE- 123 GM							
DROPSEED-STA5-SAMPLE-3-GNOME72	K	5.9E-03		GM/GM			
62 0226 015 30 6 57 10 19 1305							
102992 GNOME DATE- 10 12 72							
SIZE- 99.3 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
DROPSEED-STA5-SAMPLE-4-GNOME-72	K	1.7E-02		GM/GM			
62 0226 015 30 6 57 10 25 0915							
102993 GNOME DATE- 10 12 72							
SIZE- 106 GM							
DROPSEED-STA5-SAMPLE-5-GNOME-72	K	3.7E-03		GM/GM			
62 0226 015 30 6 57 10 31 1630							
102994 GNOME DATE- 10 12 72							
SIZE- 85.1 GM							
COMP-STA-1-DROPSEED-GNOME-72	ASH	3.5E00		PCT			
62 0226 015 30 6 50	89SR	LT7.6E01		PCI/KG	LT2.2E+00		PCI/GM
119193 GNOME DATE- 10 12 72	90SR	9.9E01	1.5E01	PCI/KG	2.8E+00	4.3E-01	PCI/GM
SIZE- 720 GM							
COMP-STA-1-BLACKGRAMA-GNOME-72	ASH	5.7E00		PCT			
62 0226 015 30 6 50	89SR	LT6.0E01		PCI/KG	LT1.1E+00		PCI/GM
119194 GNOME DATE- 10 12 72	90SR	1.6E02	2.3E01	PCI/KG	2.8E+00	4.0E-01	PCI/GM
SIZE- 651 GM							
COMP-STA-2-DROPSEED-GNOME-72	ASH	3.3E00		PCT			
62 0226 015 30 6 50	89SR	LT7.0E01		PCI/KG	LT2.0E+00		PCI/GM
119195 GNOME DATE- 10 12 72	90SR	9.53E01	1.4E01	PCI/KG	2.9E+00	4.0E-01	PCI/GM
SIZE- 907 GM							
COMP-STA-3-DROPSEED-GNOME-72	ASH	4.8E00		PCT			
62 0226 015 30 6 50	89SR	LT6.5E01		PCI/KG	LT1.4E+00		PCI/GM
119197 GNOME DATE- 10 12 72	90SR	6.2E01	1.3E01	PCI/KG	1.3E+00	2.7E-01	PCI/GM
SIZE- 690 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
COMP-STA-3-BLACKGRAMA-GNOME-72	ASH	5.9E00		PCT			
62 0226 015 30 6 50	89SR	LT8.7E01		PCI/KG	LT1.5E+00		PCI/GM
119198 GNOME DATE- 10 12 72	90SR	7.6E01	1.6E01	PCI/KG	1.3E+00	2.7E-01	PCI/GM
SIZE- 1073 GM							
COMP-STA-4-DROPSEED-GNOME-72	ASH	3.8E00		PCT			
62 0226 015 30 6 50	89SR	LT7.5E01		PCI/KG	LT2.0E+00		PCI/GM
119199 GNOME DATE- 10 12 72	90SR	7.4E01	1.3E01	PCI/KG	1.9E+00	3.4E-01	PCI/GM
SIZE- 1153 GM							
COMP-STA-4-BLACKGRAMA-GNOME-72	ASH	5.7E00		PCT			
62 0226 015 30 6 50	89SR	LT1.2E02		PCI/KG	LT2.1E+00		PCI/GM
119200 GNOME DATE- 10 12 72	90SR	2.0E02	2.4E01	PCI/KG	3.5E+00	4.2E-01	PCI/GM
SIZE- 764 GM							
COMP-STA-5-DROPSEED-GNOME-72	ASH	3.8E00		PCT			
62 0226 015 30 6 50	89SR	LT6.5E01		PCI/KG	LT1.7E+00		PCI/GM
119201 GNOME DATE- 10 12 72	90SR	7.5E01	1.3E01	PCI/KG	2.0E+00	3.4E-01	PCI/GM
SIZE- 927 GM							
COMP-STA-5-BLACKGRAMA-GNOME-72	ASH	5.8E00		PCT			
62 0226 015 30 6 50	89SR	LT1.5E02		PCI/KG	LT2.6E+00		PCI/GM
119202 GNOME DATE- 10 12 72	90SR	1.9E02	2.9E01	PCI/KG	3.3E+00	5.0E-01	PCI/GM
SIZE- 866 GM							
QUAIL-1-SALTPILE-GNOME-72	K	3.5E-03		GM/GM			
62 0226 015 30 6 77 10 16 1245							
102895 GNOME DATE- 10 12 72							
SIZE- 192 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
QUAIL-2-SALTPILE-GNOME-72 62 0226 015 30 6 77 10 16 1435 102896 GNOME DATE- 10 12 72 SIZE- 210 GM	K	2.9E-03		GM/GM			
QUAIL-3-SALTPILE-GNOME-72 62 0226 015 30 6 77 10 16 1240 102897 GNOME DATE- 10 12 72 SIZE- 182 GM	K	2.2E-03		GM/GM			
QUAIL-4-SALTPILE-72 62 0226 015 30 6 77 10 16 1425 102898 GNOME DATE- 10 12 72 SIZE- 115 GM	K	2.3E-03		GM/GM			
QUAIL-5-SALTPILE-GNOME-72 62 0226 015 30 6 77 10 16 1425 102899 GNOME DATE- 10 12 72 SIZE- 118 GM	K	2.6E-03		GM/GM			
QUAIL-6-SALTPILE-GNOME-72 62 0226 015 30 6 77 10 16 1240 102900 GNOME DATE- 10 12 72 SIZE- 217 GM	K	2.7E-03		GM/GM			
DOVE-1-SALTPILE-72 62 0226 015 30 6 77 10 16 1025 102901 GNOME DATE- 10 12 72 SIZE- 130 GM	K	3.3E-03		GM/GM			

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
QUAIL-1-WESTGATE-GNOME-72 62 0226 015 30 6 77 10 16 1025 102902 GNOME DATE- 10 12 72 SIZE- 196 GM	K	2.4E-03		GM/GM			
QUAIL-1-1MI-E-OF-STA-1-72 62 0226 015 30 6 77 10 16 1025 102903 GNOME DATE- 10 13 72 SIZE- 202 GM	K	1.4E-03		GM/GM			
QUAIL-2-1-MI-E-OFSTA-1 62 0226 015 30 6 77 10 16 1245 102904 GNOME DATE- 10 13 72 SIZE- 207 GM	K	2.7E-03		GM/GM			
QUAIL-1-1-MI-EOF-STA-1 62 0226 015 30 6 77 10 16 1025 102905 GNOME DATE- 10 13 72 SIZE- 201 GM	K	3.6E-03		GM/GM			
DOVE-1-STATION-1-GNOME-72 62 0226 015 30 6 77 10 17 0915 102906 GNOME DATE- 10 12 72 SIZE- 97 GM	K	2.4E-03		GM/GM			
DOVE-2-STATION-1-GNOME-72 62 0226 015 30 6 77 10 17 1135 102907 GNOME DATE- 10 12 72 SIZE- 121 GM	K	1.2E-03		GM/GM			

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
DOVE-1-STATION2-GNOME-72	K	1.6E-03		GM/GM			
62 0226 015 30 6 77 10 17 1135							
102908 GNOME DATE- 10 12 72							
SIZE- 145 GM							
DOVE-2-STATION-2-GNOME-72	K	2.8E-03		GM/GM			
62 0226 015 30 6 77 10 17 1135							
102909 GNOME DATE- 10 12 72							
SIZE- 142 GM							
DOVE-3-STATION-2-GNOME-72	K	4.4E-03		GM/GM			
62 0226 015 30 6 77 10 17 0915							
102910 GNOME DATE- 10 12 72							
SIZE- 142 GM							
DOVE-4-STATION-2-GNOME-72	K	1.6E-03		GM/GM			
62 0226 015 30 6 77 10 17 0915							
102911 GNOME DATE- 10 12 72							
SIZE- 135 GM							
DOVE-5-STATION2-GNOME-72	K	3.2E-03		GM/GM			
62 0226 015 30 6 77 10 17 0915							
102912 GNOME DATE- 10 12 72							
SIZE- 108 GM							
FECES-GNOMESALTPILE-72	137CS	7.1E00		PCI/GM			
62 0226 015 30 6 73 10 19 0920	95ZR	2.9E00		PCI/GM			
102995 GNOME DATE- 10 12 72	K	4.4E-03		GM/GM			
SIZE- 97.2 GM							

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		ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
FECES-STA-5-GNOME-72		103RU	0.4E00		PCI/GM			
62 0226 015 30 6 73	10 18 1200	95ZR	1.6E00		PCI/GM			
102996 GNOME	DATE- 10 12 72	K	2.3E-03		GM/GM			
SIZE- 115 GM								
FECES-50-N-OFSALT-PILE-GNOME-72		K	2.6E-03		GM/GM			
62 0226 015 30 6 73	10 18 1200							
102997 GNOME	DATE- 10 12 72							
SIZE- 71.4 GM								
COMP-AGED-QUAIL-MU-GNOME-72		K	4.5E-03		GM/GM			
62 0226 015 30 6 77	11 01 1320	MOIS	7.2E01		PCT			
102998 GNOME	DATE- 10 12 72	3H	6.6E02	2.5E02	PCI/L			
SIZE- 348 GM		HTO	4.7E02	1.8E02	PCI/KG			
COMP-AGED-QUAIL-INTES-GNOME-72		K	4.3E-03		GM/GM			
62 0226 015 30 6 77	10 31 0900							
102999 GNOME	DATE- 10 12 72							
SIZE- 149 GM								
COMP-AGED-QUAIL-FEATHERS-GNOME-72		K	2.7E-03		GM/GM			
62 0226 015 30 6 77	10 30 1353							
103000 GNOME	DATE- 10 12 72							
SIZE- 89 GM								
COMP-YOUNG-QUAIL-FEATHERS-GNOME-72		GAMMA-SPECTRUM-NEGLIGIBLE						
62 0226 015 30 6 72	10 30 1353							
119001 GNOME	DATE- 10 12 72							
SIZE- 75 GM								

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
COMP-QUAIL-YOUNG-MUSCLE-GNOME-72	K	5.4E-03		GM/GM			
62 0226 015 30 6 77 11 01 1320	MOIS	7.5E01		PCT			
119002 GNOME DATE- 10 12 72	3H	9.3E03	3.5E02	PCI/L			
SIZE- 118 GM	HTO	7.0E03	2.6E02	PCI/KG			
COMP-YOUNGQUAIL-INTES-GNOME-72	K	7.0E-03		GM/GM			
62 0226 015 30 6 78 11 01 1120							
119003 GNOME DATE- 10 12 72							
SIZE- 59 GM							
COMP-DOVE-INTES-GNOME-72	K	3.7E-03		GM/GM			
62 0226 015 30 6 77 10 31 1200							
119004 GNOME DATE- 10 12 72							
SIZE- 88 GM							
COMP-DOVE-MUSCLE-GNOME-72	K	4.8E-03		GM/GM			
62 0226 015 30 6 77 10 31 1200							
119005 GNOME DATE- 10 12 72							
SIZE- 224 GM							
QUAIL-1-BONE-SALTPILE-GNOME-72	ASH	3.8E00		PCT			
62 0226 015 30 6 77	89SR	LT1.2E02		PCI/KG	LT3.2E+00		PCI/GM
119006 GNOME DATE- 10 12 72	90SR	LT5.5E01		PCI/KG	LT1.4E+00		PCI/GM
SIZE- 77 GM							
QUAIL-2-BONE-SALTPILE-GNOME-72	ASH	5.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.7E02		PCI/KG	LT3.4E+00		PCI/GM
119007 GNOME DATE- 10 12 72	90SR	2.9E02	8.2E01	PCI/KG	5.8E+00	1.6E+00	PCI/GM
SIZE- ML							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
QUAIL-3-BONE-SALTPILE-GNOME-72	ASH	6.3E00		PCT			
62 0226 015 30 6 77	89SR	LT2.2E02		PCI/KG	LT3.5E+00		PCI/GM
119008 GNOME DATE- 10 12 72	90SR	4.1E02	1.0E02	PCI/KG	6.5E+00	1.6E+00	PCI/GM
SIZE- 76 GM							
QUAIL-5-SALTPILE-BONE-72	ASH	8.0E00		PCT			
62 0226 015 30 6 77	89SR	LT2.7E02		PCI/KG	LT3.4E+00		PCI/GM
119009 GNOME DATE- 10 12 72	90SR	1.8E02	1.3E02	PCI/KG	2.3E+00	1.6E+00	PCI/GM
SIZE- 47 GM							
QUAIL-4-BONE-SALTPILE-GNOME-72	ASH	5.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.5E02		PCI/KG	LT3.0E+00		PCI/GM
119010 GNOME DATE- 10 12 72	90SR	LT6.8E01		PCI/KG	LT1.4E+00		PCI/GM
SIZE- 39 GM							
QUAIL-6-BONE-GNOMESITE-72 SALTPILE	ASH	7.5E00		PCT			
62 0226 015 30 6 77	89SR	LT2.3E02		PCI/KG	LT3.1E+00		PCI/GM
119011 GNOME DATE- 10 12 72	90SR	LT1.0E02		PCI/KG	LT1.3E+00		PCI/GM
SIZE- 76 GM							
DOVE-1-SALTPILE-BONE-GNOME-72	ASH	4.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.3E02		PCI/KG	LT3.3E+00		PCI/GM
119012 GNOME DATE- 10 12 72	90SR	2.1E02	6.2E01	PCI/KG	5.3E+00	1.5E+00	PCI/GM
SIZE- 50 GM							
QUAIL-1-WESTGATE-GNOME-72 BONE	ASH	5.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.8E02		PCI/KG	LT3.6E+00		PCI/GM
119013 GNOME DATE- 10 12 72	90SR	LT8.0E01		PCI/KG	LT1.6E+00		PCI/GM
SIZE- 80 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
QUAIL-1-BONE-1MI-E-OF-STA-1-GNOME-72	ASH	4.4E00		PCT			
62 0226 015 30 6 77	89SR	LT1.4E02		PCI/KG	LT3.2E+00		PCI/GM
119014 GNOME DATE- 10 12 72	90SR	6.3E01	6.2E01	PCI/KG	1.4E+00	1.4E+00	PCI/GM
SIZE- 88 GM							
QUAIL-2-1-MI-E-OF-STA-1-GNOME-72	ASH	0.5E01		PCT			
62 0226 015 30 6 77	89SR	LT1.5E02		PCI/KG	LT3.0E+00		PCI/GM
119015 GNOME DATE- 10 12 72	90SR	LT7.0E01		PCI/KG	LT1.4E+00		PCI/GM
SIZE- 97 GM							
QUAIL-3-1-MI-E-OF-STA-1-BONE-GNOME-72	ASH	4.4E00		PCT			
62 0226 015 30 6 77	89SR	LT1.3E02		PCI/KG	LT3.0E+00		PCI/GM
119016 GNOME DATE- 10 12 72	90SR	LT6.2E01		PCI/KG	LT1.4E+00		PCI/GM
SIZE- 91 GM							
DOVE-1-BONE-STA-1-GNOME-SITE-72	ASH	12.5E00		PCT			
62 0226 015 30 6 77	89SR	LT4.0E02		PCI/KG	LT3.2E+00		PCI/GM
119017 GNOME DATE- 10 12 72	90SR	4.0E02	1.9E02	PCI/KG	3.2E+00	1.5E+00	PCI/GM
SIZE- 41 GM							
DOVE-2-BONE-STA-1-GNOME-72	ASH	4.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.1E02		PCI/KG	LT2.8E+00		PCI/GM
119018 GNOME DATE- 10 12 72	90SR	1.0E02	5.4E01	PCI/KG	2.5E+00	1.3E+00	PCI/GM
SIZE- 52 GM							
DOVE-1-STA-2-BONE-GNOME-72	ASH	5.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.6E02		PCI/KG	LT3.2E+00		PCI/GM
119019 GNOME DATE- 10 12 72	90SR	7.9E01	7.3E01	PCI/KG	1.6E+00	1.5E+00	PCI/GM
SIZE- 77 GM							

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
DOVE-2-BONE-STA-2-GNOME-72	ASH	4.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.3E02		PCI/KG	LT3.3E+00		PCI/GM
119020 GNOME DATE- 10 12 72	90SR	LT5.8E01		PCI/KG	LT1.4E+00		PCI/GM
SIZE- 53 GM							
DOVE-3-BONE-STA-2-GNOME-72	ASH	5.0E00		PCT			
62 0226 015 30 6 77	89SR	LT1.5E02		PCI/KG	LT3.0E+00		PCI/GM
119021 GNOME DATE- 10 12 72	90SR	1.0E02	6.7E01	PCI/KG	2.0E+00	1.3E+00	PCI/GM
SIZE- 60 GM							
DOVE-4-BONE-STA-2-GNOME-72	ASH	3.3E00		PCT			
62 0226 015 30 6 77	89SR	LT1.0E02		PCI/KG	LT3.0E+00		PCI/GM
119022 GNOME DATE- 10 12 72	90SR	LT4.5E01		PCI/KG	LT1.4E+00		PCI/GM
SIZE- 57 GM							
DOVE-5-GNOME-SITE-STA-2-BONE-72	ASH	2.5E00		PCT			
62 0226 015 30 6 77	89SR	LT7.6E01		PCI/KG	LT3.0E+00		PCI/GM
119023 GNOME DATE- 10 12 72	90SR	7.8E01	3.5E01	PCI/KG	3.1E+00	1.4E+00	PCI/GM
SIZE- 39 GM							
RABBIT-1-SKIN-GNOME-72	K	2.9E-03		GM/GM			
62 0226 015 30 6 70 10 31 1350							
119024 GNOME DATE- 10 12 72							
SIZE- 98 GM							
RABBIT-1-MUSCLE-GNOME-72	K	3.4E-03		GM/GM			
62 0226 015 30 6 67 10 31 1350	MOIS	7.6E01		PCT			
119025 GNOME DATE- 10 12 72	3H	4.7E02	2.6E02	PCI/L			
SIZE- 233 GM	HTO	3.6E02	2.0E02	PCI/KG			

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	ANALYSIS	RESULT	2SIGMA	UNITS	ASHED	2SIGMA	UNITS
RABBIT-1-INTESTINES-GNOME-72	K	4.3E-03		GM/GM			
62 0226 015 30 6 78 10 31 0900							
119026 GNOME DATE- 10 12 72							
SIZE- 124 GM							
RABBIT-BONE-GNOME-72	ASH	6.9E00		PCT			
62 0226 015 30 6 77	CA	NA					
119027 GNOME DATE- 10 12 72	89SR	LT2.6E02		PCI/KG	LT3.8E+00		PCI/GM
SIZE- 351 GM	90SR	1.2E02	6.8E01	PCI/KG	1.7E+00	9.9E-01	PCI/GM
COMP-DOVE-MU-GNOME-72							
62 0226 015 30 6 73	ASH	1.4E00		PCI			
119210 GNOME DATE- 10 13 72	238PU	LT1.6E-01		PCI/KG	LT1.1E-02		PCI/GM
SIZE-220 GM	239PU	LT5.9E-02		PCI/KG	LT4.2E-03		PCI/GM

APPENDIX II. Minimum Detectable Activities by Gamma Spectroscopy, Technical Services Program, National Environmental Research Center-LV, Environmental Protection Agency

The minimum detectable activities (MDA's) in terms of total activity per sample for standard geometries and counting times are based on a combination of a number of technical experiments and operational experience. By means of experimentation the MDA has been defined as that activity which produced a ±100% deviation at the 95% confidence level. On the basis of experience, the MDA is defined as that activity which can be positively identified on a net spectrum plot. These values are applicable to ideal conditions and simple complexes of nuclides. Complex spectra or spectra showing natural contamination can raise the MDA's considerably.

Minimum Detectable Activities in pCi for Total Sample

	10 Min Count	40 Min Count			100 Min Count		
Isotope	Planchet	Planchet	400 ml	3.5 l	400 ml	1000 ml	3.5 l
^{54}Mn	50	25	40	35	25	25	22
^{65}Zn	500	250	400	350	250	250	220
^{60}Co	50	25	40	35	25	25	22
^{95}Zr	50	25	40	35	25	25	22
^{103}Ru	50	25	40	35	25	25	22
^{106}Ru	500	250	400	350	250	250	220
^{124}Sb	50	25	40	35	25	25	22
^{125}Sb	250	125	200	175	125	125	110
^{132}Te	50	25	40	35	25	25	22
^{131}I	50	25	40	35	25	25	22
^{133}I	50	25	40	35	25	25	22
^{137}Cs	50	25	40	35	25	25	22
^{140}Ba	50	25	40	35	25	25	22
^{141}Ce	250	125	200	175	125	125	110

APPENDIX II. Minimum Detectable Activities by Gamma Spectroscopy (cont'd)

	10 Min Count	40 Min Count			100 Min Count		
Isotope	Planchet	Planchet	400 ml	3.5 l	400 ml	1000 ml	3.5 l
^{144}Ce	500	250	400	350	250	250	220
^{181}W	600	300	475	425	300	300	260
^{3}H		0.4 pCi per ml of H_2O					
^{89}Sr		5.0 pCi total sample of ash					
^{90}Sr		2.0 pCi total sample of ash					
^{238}Pu		0.01 pCi per gram of ash					
^{239}Pu		0.01 pCi per gram of ash					
K*	0.5	0.3	0.4	0.4	0.3	0.3	0.25

*g/kg

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