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Fallout ^{131}I in Western Nevada Cattle Thyroid Glands: 1962–Early 1969

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There has been continuing interest in historical fallout data (DAAG 1987; Black and Potter 1986; Haylin 1988; Stevens *et al.* 1990). We have previously published data concerning the concentrations of fallout radioactive ^{131}I in the thyroid glands of cattle from the Nevada Test Site and from commercial slaughter cattle (Blincoe 1960; Blincoe and Bohman 1962a, 1962b, 1964, 1969, 1970; Blincoe *et al.* 1964). These data showed that bovine thyroid ^{131}I was an effective monitor of both local and worldwide fresh nuclear fallout. This paper extends our data on commercial slaughter cattle from western Nevada through early 1969.

METHODS AND MATERIALS

Thyroid glands from cattle coming to commercial slaughter were collected from a abattoir in Yerington, Nevada, before June 1966 and later from the University of Nevada Reno facility in Reno, Nevada. The cattle supply to these facilities was almost exclusively from local sources. Cattle had generally spent the last few months before slaughter within 20 km of these two cities and in the environment of the western Great Basin. The collection of the glands and their preparation for radioiodine assay was described previously (Blincoe *et al.* 1964).

Four gram samples of fresh thyroid tissue were measured in each of two well-type, solid-crystal NaI(Tl) scintillation counters, single-channel pulse height analyzers and scalers. The measurement of ^{131}I in the thyroid glands has been described (Blincoe *et al.* 1964). All data was decay corrected to the data of slaughter.

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All data concerning nuclear detonations are from published listings (Glasstone, 1964; U. S. Atomic Energy Commission, Commission, 1968) or news sources. The locations of nuclear weapons tests are given in Glasstone (1964) except for the French tests in the south Pacific and Chinese tests in western China (PRC).

RESULTS AND DISCUSSION

Data are reported as becquerels per gram of fresh tissue (Bq/g). The analytical error, as determined by duplicate sample measurements was reported to be ± 0.026 Bq/g (Blincoe and Bohman 1970).

The data are plotted in Figure 1. Several occurrences of data greater than 0.08 Bq/g were noted (Table 1). These concentrations were three times the standard deviations of measurement of radioiodine and were thus considered significant.

The same instrumentation used in all our previous ^{131}I studies was used in this study and measurements were by the same personnel as in previously published studies. For some time periods, measurements reported here were made while collecting previously reported data. The sampling schedule was determined by published nuclear weapons tests reports, availability of samples and personnel, etc.

Known releases of ^{131}I to the atmosphere which appear to be related to the higher concentrations of thyroid radioiodine are given in Table 1. A concentration greater than three standard deviations of measurement was considered significant.

The high values noted in 1962 and early 1963 coincide with test series by the United States and the Union of Soviet Socialist Republics (USSR). These data are plotted as Figure 2. The 1962 test series included nuclear devices reported to have yields up to 40 MT (megaton, TNT explosive equivalent force). The high yield tests were at a considerable distance from Nevada. The highest level reported here was 4.9 Bq/g compared with a maximum of 216 Bq/g found during the USSR test series of 1961 (Blincoe and Bohman 1962a). The largest test in 1961 was reported to have been about 100 MT.

On 05/24/65 and 05/27/65 thyroid iodine concentrations of 0.2 and 0.3 Bq/g respectively were noted. Individual glands ranged from 0.06 to 0.5 Bq/g. This appears to correspond with the 'Palanquine' cratering test of 04/14/65. This test was the subject of another report (Bohman *et al.* 1968). The fallout from 'Palanquine'

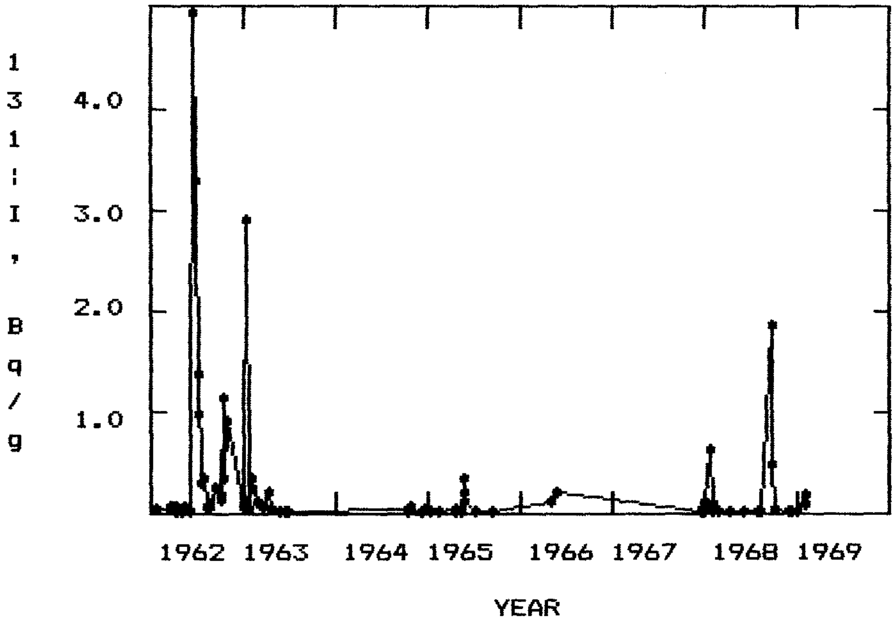

Figure 1. Thyroid 131-I in western Nevada cattle.

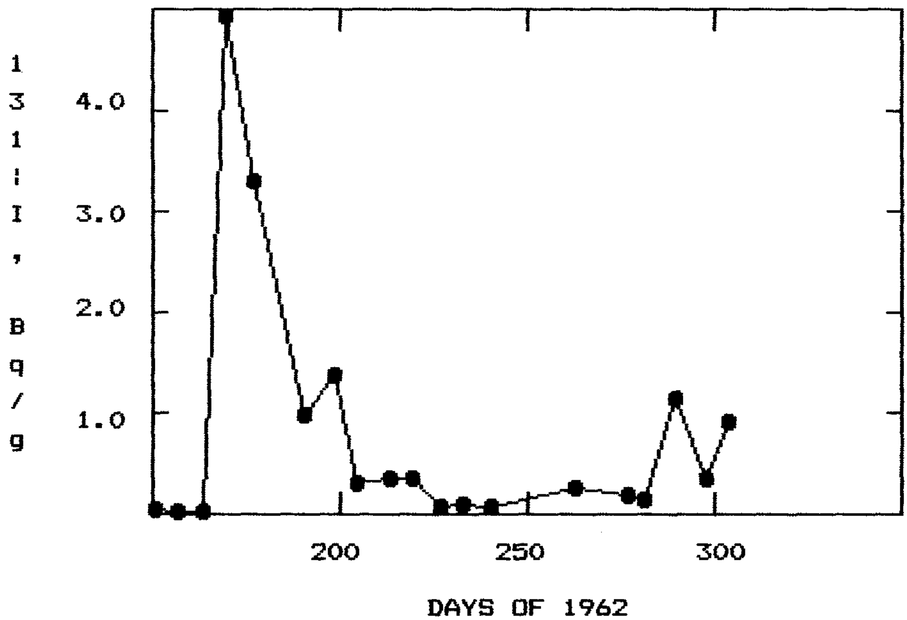

Figure 2. Thyroid 131-I in western Nevada cattle during 1962 atmospheric nuclear weapons test series.

Table 1. Documented atmospheric fission product releases associated with observed higher concentrations of ^{131}I in western Nevada cattle.

Observed ^{131}I Maximum		Fission Product Releases	
Date	Bq/g	Date	Description*
06/62-01/63	4.9	04-11/62	Pacific, NTS, and USSR (Novaya Zemlya) tests.
05/27/65	0.33	04/14/65	'Palanquin' cratering test, NTS.
		05/07/65	'Tee' test escape, NTS.
		05/14/65	Chinese test.
05/31/66	0.20	04/25/66	'Pin Stripe" test escape, NTS.
01/31/68	0.61	01/18/68	'Hupmobile' test escape, NTS.
		01/26/68	'Cabriolet' cratering test, NTS.
09/26/68	1.9	07-09/68	French Test Series, south Pacific.
02/10/69	0.17	12/08/68	'Schooner' test, NTS.

* 'NTS' refers to the Nevada Test Site.

was reported to take a path due north from the site of detonation. The initial fallout thus passed well to the east of the cattle sampled on 05/24/65 and 05/27/65 at Yerington, Nevada. The thyroid concentrations were well below those reported in the direct fallout path through Nevada. Near the center of the fallout path, thyroid ^{131}I concentrations decreased from 13430 Bq/g to 59 Bq/g as one moved north from the Nevada Test Site. (Bohman *et al.* 1968). An atmospheric nuclear detonation in China on 05/14/65 may have made a major contribution to the ^{131}I concentrations observed in western Nevada. Some contribution from a vented underground test ('Tee') on 05/07/65 cannot be ruled out. Whicker *et al.* (1966) reported increases ^{131}I in deer and elk thyroid glands collected in Colorado at this time. Their reported maximum of about 7 Bq/g was greater than we found for cattle. The increase noted in western Nevada was probably due to Chinese and 'Palanquin' fallout after considerable atmospheric dilution.

The increase of 05/31/66 is at the right time to be from a Chinese test of 05/09/66 and from the venting of the 'Pin Stripe' test in Nevada on 04/26/66. Reports indicated, however, that these fission products from

the 'Pin Stripe' escape went due East from the site of venting and that the release was small. The increase in western Nevada ^{131}I probably resulted from the Chinese test.

'Cabrolet' was a cratering test in Nevada on 01/26/68. It was preceded by a venting of an underground test ('Hupmobile") on 01/18/68). The increased iodine noted on 01/31/68 may be mainly resulting from 'Cabrolet' fallout. Van Middlesworth (1969) found increased radioiodine in Tennessee cattle to about 1 Bq/g at the same time.

A small increase to 1.9 Bq/g on 09/26/68 occurred shortly after a test series was conducted in the south Pacific by the French. A much larger increase in thyroid fallout radioiodine was reported by Van Middlesworth (1969) especially in the southern Hemisphere. The thyroid ^{131}I of cattle in New Zealand increased from about 0.04 Bq/g to about 15 Bq/g.

The very small increase to 0.2 Bq/g noted on 02/13/69 may be associated with the 'Schooner' text in early December 1968 at the Nevada Test Site. Since no increase in cattle thyroid ^{131}I was noted in late December and January other sources of atmospheric radioiodine cannot be ruled out.

Our data show considerably less increase in thyroid ^{131}I concentrations in response to atmospheric contamination than comparable data from other investigators. This is probably due to our desert conditions. The cited data was collected in areas of relatively high precipitation. These areas of greater rainfall will have greater contamination of feed from atmospheric fallout.

These data once again emphasize the value of the use of cattle in a fallout monitoring program. They ingest and/or inhale large quantities of contaminated feed or air and concentrate a large portion of this radioiodine into the thyroid gland. This relatively small gland is easily sampled at slaughter with very little or no loss of commercial value to the carcass. The measurement of thyroid ^{131}I reflects only recent fission products since the nuclide has a half-life of 8 days. ^{137}Cs in muscle or liver can be used to used to monitor older fallout and ^{90}Sr in bone is an indicator of life-long fallout exposure (Blincoe and Bohman, 1969).

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