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400398 4/10/89

NOTE TO JOHN RUDOLPH

SUBJECT: THE NORTHERN MARSHALLS SURVEY

The conduct of an aerial radiological survey at Enewetak Atoll in preparation for cleanup raised the possibility of conducting a similar survey of other locations that could have been impacted by fallout from tests at Bikini and Enewetak Atolls. The purpose of this latter survey would be to collect a body of radiological information to support negotiations for ending the U.S. Trust in the Pacific. What follows is a review of how that survey was planned. A copy of the RADIOLOGICAL SURVEY PLAN FOR THE NORTHERN MARSHALLS, dated August 22, 1978, is attached.

The idea for a radiological survey of all islands and atolls that may have been impacted by U.S. nuclear tests in the Marshalls was my own. As this idea developed, there was the problem of how to plan a survey that would cover enough area and atolls to define the region where higher levels of fallout may have occurred, but not so extensive and costly that funding could not be obtained. A plan was developed to conduct a screening survey that would characterize radiological conditions and indicate where any additional radiological measurements should be made. If the aerial radiation data collected during the survey suggested more measurements should be made and this could be accommodated during the survey, this would be done. Otherwise, this data would be used to justify additional surveys at a later time if this was needed.

As to how islands and atolls were selected to be included in the survey, this was done on the basis of an inspection of all available reports and data collected during and following nuclear test operations in the Marshalls. Major sources of information were the series of Weapon Test Reports, WT's, classified reports issued for each test series; a compilation of meteorological data and fallout patterns in DASA 1251, a classified report prepared by the Defense Atomic Support Agency; and reports on the accident with the Bravo test in 1954 issued by Dr. Robert Conard of the Brookhaven National Laboratory. The only dose estimates we found were in Dr. Conard's reports with estimates of acute radiation doses that applied only to the Bravo accident. The WT's and DASA 1251 contained contours of radiation dose rate expressed as r/hr at H+1 hour for many tests. All available information was reviewed to determine the most likely areas impacted by fallout from each nuclear test.

Additional dose rate measurements were available in the scientific literature for a number of locations throughout the Trust Territory. These were obtained during visits by scientist using portable instruments. These data showed radiation levels in the rest of the Trust Territory no higher than would be expected from worldwide fallout.

The object of the literature search was to identify those locations that most likely received the intermediate range fallout deposition from tests with the higher yields. We examined fallout patterns for all tests, but considering the distances between Bikini and Enewetak Atolls and other islands and atolls in the Marshalls and the large areas impacted by megaton yield tests, only tests with a yield above 100 kilotons gave fallout patterns of sufficient dimensions that they could add any additional locations for this survey. While on this subject, I should point out that there was one series of tests where yields had not been published in the open literature at the time of this review. While fallout from the Redwing series was included in the evaluation of which atolls to survey, you will not find tests from this series listed in the Table we developed showing which tests may have impacted which atolls. See attachment.

Out of this review thirteen islands and atolls were identified, all in the Northern Marshalls. These lie along a track East and West of the test atolls that is about 500 miles long. Why this would be so is due to efforts by the Joint Task Force conducting these tests to direct fallout away from populated areas. This would preclude selecting a shot day where meterological data indicated fallout would be carried to the South.

Planning for a screening survey called for measurements to be made in each quadrant of an atoll, for the largest islands, and for any village island. Not every island in a atoll was included in the survey plan. In addition to aerial measurements, the survey included collection of environmental samples to support estimates of radiation exposure through food intake. The final reports of the survey issued by the Lawrence Livermore Laboratory contained estimates of projected (future) radiation exposure for a resident population for the islands and atolls surveyed.

My observations of the radiological data collected during the Northern Marshalls Survey, and I was a participant for the first leg or series of the survey, was that there were no surprises in the character of the measurements. It was expected that radiation levels would decrease with distance from the test atolls. This was observed in the aerial

measurements and later confirmed when the collected environmental samples were analyzed.

The survey report issued by staff of EG&G who conducted the aerial portion of the Northern Marshalls Survey states that except for Bikini, Rongelap, and Rongerik Atolls, the island average values of external radiation were essentially constant within each atoll. This indicates that no sharp gradients were observed in the radiation levels within these atolls. The islands and atolls along the southern edge of the survey area showed external radiation levels that are very low. The statement is made in this report that it would be difficult with standard survey instruments to measure the difference between radiation levels over water or over land for the southern atolls surveyed, namely, Ailik, Likiep, Wotho, and Ujelang. These atolls have terrestrial radiation levels lower than in the U.S. except that in the U.S. the radiation is due primarily to naturally occurring radioactivity, and that for these coral atolls is due to Cesium-137 from fallout. The Cesium-137 levels in soil of these atolls are comparable to, and consistent with, worldwide fallout levels.

After reviewing the survey reports it was my view that we had surveyed the right islands and atolls, and that the geographic extent of the survey was about right, i.e. we had not surveyed islands and atolls that did not need surveying.

I am sad that the survey I helped initiate produced a report that has received so much criticism and ridicule, and long ago tired of waging a losing battle against changing the way these survey results and radiological advice were presented in the Marshalls. The survey report was confusing because it presented estimates of risk and health effects in the next thirty years due to future exposures without saying anything about risks for exposures during the previous thirty years. It appeared that important results were being withheld and that the Marshallese were being required to make important health and safety judgements using piecemeal risk information. The report interpreted hypothetical risk and health effects estimates too literally and pushed their use in health and safety judgements too far. The practice of providing advice based on radiation standards was abandoned. This was a frightening development, particularly for the Rongelap people, some of whom received significant exposure in 1954. The Marshallese have yet to receive an explanation of how estimates of past and future exposures fit together into total exposure, how this total exposure may be evaluated, and how their chronic exposures (annual dose rates), past and future, compare with radiation protection standards.

It is not my place to say don't survey elsewhere in the Marshalls or in the Trust Territory. There has been some fallout there. However, on the basis of the measurements I have seen, and these can't compare with the data collected in the Northern Marshalls, I would expect to find deposition and exposure levels not significantly different from those attributable to worldwide fallout.

I hope this review of history answers some of the questions on how the islands and atolls were chosen for the Northern Marshalls Survey. If there is any additional information I can provide, please let me know.

Tom McCraw

Tom McCraw

c.c. Harry Brown