

memorandum

DATE: June 23, 1987

REPLY TO
ATTN OF: EH-35

SUBJECT: Benefits from Foreign Travel

TO: Mary L. Walker, EH-1

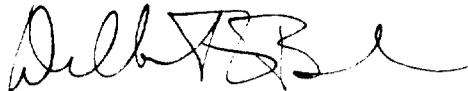
Dr. Richmond's attendance at the 8th International Congress of Radiation Research (ICRR) in Edinburgh, Scotland, is important because of the widespread interest in environmental contamination by transuranium elements. The U.S. Department of Energy (and predecessor agencies) has provided support to the Spanish Government since the accident in 1966 in which plutonium was released from two thermonuclear weapons (abstract attached).

The goals of the joint agreement developed after the accident were to study the consequences of the accident in terms of crops, air, soil, and people. Another goal was to get the results presented at international meetings and published in peer-reviewed journals. One article has just appeared in the Journal of the Health Physics Society (April 1987). Drs. Richmond and Iranzo expect to publish the material to be presented at the ICRR meeting. The results of the studies of the contaminated environment at Palomares, Spain have been of particular interest in Europe.

The topic is also of much interest to the international community. Presentation of this information indicates that the U.S. has lived up to its commitment in this instance.

I recommend Dr. Richmond attend the ICRR Conference. Dr. Iranzo presented a paper in the U.S. several years ago. His English was very difficult to understand. It is proposed that Dr. Richmond will deliver the paper and Dr. Iranzo will assist with any questions.

While in Scotland, Dr. Richmond will also be able to discuss the work in Spain with Dr. Iranzo. In essence, this will eliminate the need for a separate trip to Spain this year.



Delbert F. Bunch
Acting Deputy Assistant Secretary
Safety, Health and Quality Assurance

Attachment

ABSTRACT FORM to be returned with the registration form and fee to the address given on Form X BEFORE 31 JAN 1987. Do select topic in box on right.

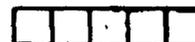
Send original plus two copies

Abstracts should be typed in the style of the example below. Type directly onto this form, original size, not using dot matrix printer.

DO NOT FOLD OR CREASE THE CENTRE SECTION OF THIS FORM.

Dr. Emilio Iranzo
 Junta de Energia Nuclear
 Avenida Complutense
 Madrid 3, Spain

TYPE PRINCIPAL
 AUTHOR'S NAME
 POSTAL ADDRESS



Please do not write in this space.

Select topic group for your proffered paper from list in 2nd Announcement (Letter & Number)

1st choice
 2nd choice

PLUTONIUM CONTAMINATION TWENTY YEARS AFTER THE NUCLEAR WEAPONS ACCIDENT IN SPAIN.
 E. IRANZO AND C.R. RICHMOND. Junta de Energia Nuclear (Spain) and Oak Ridge National Laboratory (USA).

In January, 1966, a USAF D-52 bomber carrying four nuclear weapons collided with a KC-135 tanker over SE Spain. The parachutes of two bombs did not deploy causing non-nuclear detonation and burning of fissile material at impact. A joint US-Spain effort resulted in the establishment of clean up levels, removal of contaminated soil to the US and an assessment of the residual contamination on the environment and people. Four air sampling stations, six study plots for obtaining soil and plant samples, and protocols for follow-up studies of human subjects were established.

Only rarely are edible portions of food crops found to contain Pu. These levels are usually low as compared to naturally occurring alpha-emitting radionuclides. Wild vegetation can collect Pu to considerably higher levels in some locations. Residual Pu in soil is variable because of initial concentration and aggregation with iron and carbonate compounds; it tends to be more homogeneously distributed in farmed areas. Air concentrations are highest in arid areas where residual contamination was highest. Calculated doses for chronically exposed people in these areas are small. Chest burdens of Pu for about 600 individuals are below the detector's minimum detectable level of about 20 nCi. Bioassay data are difficult to interpret because of the small number of measurements on any individual, the relative rarity of values above the detection limit of the measurement system and the assumptions in the metabolic models used.

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TITLE IN CAPITAL LETTERS, PREFERABLY ONE LINE ONLY, BUT IF IT EX
 INSET THE 2ND LINE. START AUTHORS' NAMES ON A NEW LINE
 E.M. FIELDEN, J.F. FOWLER, J.H. HENDRY & D. SCOTT. *Brief* address
 too many lines) in lower case typing.

Start the abstract with a paragraph inset and leaving a single or $\frac{1}{2}$ blank line space. It should be typed single spaced and can have paragraphs. Do not reduce your abstract on a copier. Type directly onto this form using a new black or a carbon ribbon, and not using a dot matrix printer. Abstracts will be copied three to each page, slightly reduced in size. There will be somewhat less than 200 words.

Abstracts should be scientifically informative, indicating results and conclusions.

Deadline for receipt is 31 January 1987. Abstracts received late will have to be declined.

Please send original abstract form plus two copies, together with your registration form and fee, to: 8th I.C.R.R. Secretariat, CEP Consultants Ltd., 26 Albany Street, Edinburgh EH1 3QH. The decision to group Abstracts into poster or oral sessions will be taken on the basis of suitable numbers of abstracts on a homogeneous topic (10-12 oral presentations in 1 $\frac{1}{2}$ hours or 20-25 posters in a group).

20 years after bomb accident —

Richmond finds no health effects

By ALEX KETO

Twenty years ago on Jan. 17, 1966, above a small pueblo village in southeastern Spain, a tremendous fireball erupted in the sky, and flaming wreckage of a B-52 bomber and a KC-135 strato tanker refueling plane rained down on the community of Palomares. Among the pieces of wreckage that fell were four thermo-nuclear bombs.

During a mid-air refueling operation, the B-52 carrying the four thermo-nuclear weapons collided with the tanker plane. Both were destroyed in the explosion and seven crew members lost.

Two of the bombs floated down on parachutes. One landed on the beach of the Mediterranean Sea which is in sight of the village. The other sank into the sea.

The other two bombs fell as they would in war — straight down. The bombs underwent a chemical explosion on impact, fragmented, and their plutonium cores burned to a fine particle form which blew over the village.

The bombs did not detonate a thermo-nuclear reaction, but the plutonium has a half life of 24,000 years.

Chester Richmond has studied the



During a refueling operation similar to this one, the B-52 bomber, left, collided with a KC-135 Stratotanker refueling plane. (Photo courtesy of press liaison McGhee-Tyson Air Force Reserve base)

site of the accident since it occurred. Richmond took over supervision of the study project in 1971, and now coordinates work monitoring with Spain's scientists. Richmond is with Martin Marietta Energy Systems central administration at Oak Ridge National Laboratory.

The two exploded bombs left 10-

foot craters: one a mile and a half west of the village and the other on the edge of the village "so close that the explosion knocked a man over." Richmond said.

"The damages were only to crops. There was very little physical damage to the village," he recalled. The tomato crop was eradicated to avoid spreading contamination.

Immediately after the accident, the U.S. government paid the villagers restitution for the loss of crops and other damage. Since then, the U.S. has provided funding for equipment and the monitoring program in Spain.

In the first days after the accident, several "fingertip to fingertip" searches, with people lined up no more than arms' length apart, were conducted on the area to uncover portions of the bombs and parts of the wreckage, Richmond said.

A field radiation monitoring survey revealed a total of five acres of heavily contaminated land in the path of the wind borne plutonium. A larger number of acres received smaller doses of plutonium contamination.

Six inches of soil were scraped off the heavily contaminated areas and packaged the dirt in steel drums which were shipped to a burial site at Savannah River, S.C.

The less contaminated acres were plowed under. Approximately 5,000 GIs participated in the clean-up. "The plowing got the plutonium off the surface and diluted it through the ground," Richmond explained.

copies: E. Iranzo
T. McCraw
B. Wachholz
CRRichmond
3/3/86



U.S. GIs load drums of contaminated soil onto an assault ship. The drums were later transferred to freighters. (Photo courtesy of ORNL)

"This was the first time that a large area of land had been contaminated," Richmond recalled. "Procedures had to be devised on the spot to remove the plutonium."

"The concern was if the material became airborne, people could breathe it into their lungs," he said. Once within the lungs, the plutonium has a chance to reach other areas of the body, he said, pointing out that within the body, plutonium has a half life of 50 to 60 years as it is metabolized out.

"There was less danger if people ingest the plutonium because the alpha rays (radiation from the plutonium) only penetrate to a depth of one or two cells and then leave the body," Richmond said. "If you were to handle plutonium that was not going through fission, it would feel warm to the touch, but the alpha rays would not penetrate beyond the layers of dead skin."

For 80 days after the collision, the military searched for the missing fourth bomb. "There was great concern that the Soviets had midget subs in the area combing the bottom, but of course they didn't. A fisherman kept telling the search teams, which were using extremely sophisticated equipment, that the bomb fell in a particular area of the sea. They didn't listen to him, but he seemed to be pretty sure of it. When they looked in that area, they found the bomb."

Four months after the the accident occurred, the clean-up had largely been completed.

Twenty years later, despite alarm over the consequences of the village being dusted with plutonium, monitoring has revealed little to indicate that the health of the villagers was affected, according to Richmond.

"The two key things learned in the studies since the accident are that the plutonium does not seem to have had any biological effect on the villagers, and we are not able to measure any plutonium in body count devices, which means the plutonium levels, if there are any, in the villagers, must be low — extremely low.

"These rare events are important enough to follow up. The world had no information on the adverse effects of plutonium on a large population of people. It was a unique scene in Spain," Richmond said.

"In the last ten years, a lot of people have been to Madrid for monitoring three to five times. Some people occasionally still have what may be in the range of slightly higher than normal readings of alpha rays in a urine test, but sometimes the readings from the same people is slightly lower than that of natural background readings, so it is hard to say where the fluctuation comes from."

Between six and seven tons of plutonium have been released into the atmosphere because of atmospheric testing of nuclear weapons, Richmond points out. By now, most of that plutonium has fallen back to earth, he notes.

A world survey of data has shown that plants naturally register readings of alpha rays, Richmond said. The levels of plutonium alpha rays in plants is extremely small compared to the naturally occurring alpha rays.

The results, of the monitoring are quite different to conditions in Hiroshima, Nagasaki, and particularly Bikini Atoll which was recently deemed unsafe for habitation. The essential difference is that the radiation from the two bombs at Palomares was not the result of fission.

"If you fission uranium or plutonium, then you have very predictable byproducts. There are two peaks on the graph of fission output clustering around strontium 90 and cesium 137. The materials produced by the explosions at Bikini are a lot more mobile," Richmond explained. "Both elements are taken up in plants very easily." He has also been involved with the monitoring of Bikini Atoll.

Plutonium is poorly absorbed by plants and since the crops of edible plants bear fruit once and are replaced, little plutonium is taken up in the food of Palomares. "Never have we found that the tomatoes or the beans themselves have been contaminated," Richmond said.

Questions in Spain have been raised about U.S. liability to the villagers now, he said, adding that there were no plans to end monitoring.

"Although questions have been raised as to whether U.S. liability ends after 20 years under Spanish law, no one has been able to find that ordinance. We plan to continue working with the Spanish scientists," Richmond said.

Plans have already been made to resurvey the entire village for radioactivity.



RICHMOND