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February 29, 1984

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J. W. Thiessen, M. D.  
Deputy Associate Director  
Office of Health and Environmental  
Research ER-71  
U. S. Department of Energy  
Washington, DC 20545

Dear Joop:

I enclose for your information a copy of an extensive internal report to me from Dr. Hubner about the recent assistance provided by the REAC/TS staff to the Mexican physicians and their patients involved in the 1983 Juarez cobalt-60 accident.

This report is not intended for publication but you can use it as you see fit. We intend to limit its circulation to Joe Deal, Gerald Hanson, PAHO, and Joseph Laflaur, NRC, and others with a bona fide need to know.

Sincerely,



C. C. Lushbaugh, M. D.

CCL:fb

Attachment

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REPOSITORY DOE-FORRESTAL

COLLECTION MARKEY FILES

BOX No. 3 OF 6

FOLDER LUSHBAUGH MEXICAN ACCIDENT  
COBALT-60

## REPORT ON REAC/TS RESPONSE TO REQUEST FOR ASSISTANCE

### THE MEXICAN 1983/1984 COBALT-60 ACCIDENT

Karl F. Hubner, M.D.  
February 24, 1984

This trip report on the Mexican  $^{60}\text{Co}$  accident is (1) an account of the events that led up to our (REAC/TS) involvement in this accident, (2) a report of our activities and accomplishments, and (3) a summary of the recommendations I made to the physicians and officials at the meeting in Juarez on February 18, 1984.

#### (1) History of the 1983/84 Mexican Cobalt-60 Accident

At first we learned through scanty newspaper reports that appeared in various parts of the U.S. that radioactive contaminated steel had been imported from Mexico. It also had been used in the manufacture of tables and chairs, made by an American company (Falcon) in Juarez, and thus presented a radiation hazard to members of the U.S. population. The origin of the radioactive material,  $^{60}\text{Co}$ , was discovered accidentally when on January 16, 1984, "a driver with a long flatbed truck mistakenly drove through the entrance gate to the Meson Physics facility at Los Alamos. Several minutes later, realizing his mistake, he drove out with his load of two bundles of rebar intact. As the driver slowed his truck over the speed ditch at the exit from LAMPF, a radiation detector (under a manhole cover in the road) picked up radiation levels higher than background levels" [Los Alamos News Bulletin (copy attached), Vol. 4, No. 4, January 27, 1984]. Subsequently the  $^{60}\text{Co}$  was identified in the rebar and traced back to the Phoenix junkyard in Juarez. Investigations at the junkyard indicated that  $^{60}\text{Co}$  must have been there at least since December 6, 1983, since a contaminated bill of lading at Phoenix was dated 12/6/83. Some of the people employed at the junkyard underwent medical examinations on January 25, 1984.

On February 10 and 13, Dr. Lushbaugh and I had contacted Dr. Jerry Hanson at PAHO (Washington Office) and inquired whether REAC/TS, the WHO assistance center for radiation accidents in the Americas could be of help. Dr. Hanson indicated PAHO cannot initiate any action unless asked by the Mexican government.

On February 13, Mr. Don Busik (Stanford Accelerator Center), a former REAC/TS course participant, asked whether we had been called for assistance. The Mexican  $^{60}\text{Co}$  problem had been brought to Busik's attention by Mr. Jack Hornor, NRC Region 5. We learned that a  $^{60}\text{Co}$ -teletherapy source (originally 1000 Ci in 1976) had ended up in a junkyard in Juarez and two people had received total body doses of 450 rem and 100 people who are living near the junkyard are being exposed in a radiation field of 25 mR/hr. Some of the contaminated scrap has been taken to 4 different foundries or factories in Mexico (Aceros in Chihuahua, Falcon in Juarez, a valve factory in Torreon, a special steel producer in Guadalajara). Eventually 600 tons of contaminated rebar were sold to U.S. firms.

Mr. Jack Hornor confirmed Mr. Busik's report. He said that four persons may have received as much as 450 rem TBI, and one person received 15,000 rem to his hand. None of the patients were hospitalized. According to Jack Hornor some of the pellets containing the  $^{60}\text{Co}$  have been spread throughout the junkyard and the city of Juarez. Apparently the pellets attached to shoes and car tires and were thus carried out of the junkyard. Sixty-two pellets have been retrieved so far. Mr. Hornor indicated that the radiation levels in the junkyard were as high as 600 R/hr and the radiation field outside was 25 mR/hr. This information is based on radiation surveys which were performed by Mr. Greg Yuhas, H.P. NRC Region 5. We also learned that 100 tons of the contaminated steel have been used to manufacture tables and chairs which have been sold (total of 12,000 to 20,000 pieces) in the U.S. (distributed by Falcon, St. Louis, Mo.). Some of these items have been shown to emit as much as 350 mR/hr on the surface.

On February 13, Dr. C. C. Lushbaugh was informed by Mr. Joe Le Fleur (NRC) that a Mr. Jorge Trevino of the Commission on National Nuclear Safety and Safeguards (CNSNS) had appointed two physicians in Mexico City, Dr. Jorge Maisterrena (nuclear medicine) and Dr. Carlos Armendades (radiation oncology), to evaluate the medical aspects of the situation.

I called Dr. Maisterrena on February 13 in order to get his assessment of the situation in Juarez. He told me the  $^{60}\text{Co}$ -bomb which had never been installed had been setting in a warehouse since 1976. The source was stolen and taken to the junkyard. He said three workers had received between 250 and 500 rem during December and January (protracted exposure 1 to 2 hrs/day for two or three weeks). According to Dr. Maisterrena only one of the men had a low white blood cell count ( $2000/\text{mm}^3$  about 3-1/2 weeks ago). He also mentioned that the man who had brought the  $^{60}\text{Co}$ -source to the junkyard had developed "hand burns." Even though some of the pellets have been traced out of the junkyard, Dr. Maisterrena felt that the problem and danger are confined to the junkyard and that the doses outside were insignificant. I told Dr. Maisterrena that they have a serious problem in Juarez and something needs to be done to identify the persons who have been injured and to bring the contamination problem under control. He replied he would talk to someone at the Commission about the situation, and I should call him again in 24 hrs.

Later on February 13, I talked with Jerry Hanson again, and he indicated that he had talked with Mr. Joe Lubenau (NRC), Mr. LeFleur (NRC), and Sr. Roberto Trevino (CNSNS, Mexico City). They had reached the conclusion that the situation may be much worse than it was felt to be initially.

On February 14, Mr. Joe Deal (U.S.DOE) related to me that the U.S. Army personnel (Fort Bliss) had monitored the Juarez/El Paso area, however, with apparently inadequate instruments, so that a resurvey is needed. Mr. Deal told me he was in the process of writing a memo to Mr. Jan Marris (U.S. DOE) about the situation in Juarez and about possible REAC/TS involvement.

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I called Dr. Maisterrena back on February 14 as he had requested. He informed me that he and Dr. Carlos Armendades will fly to Juarez on February 18 to examine the five "high dose" patients. He invited me to join him in Juarez to see the patients with him. I told Dr. Maisterrena - pending an approval by DOE - I would be there to examine the patients and to collect blood for cytogenetic studies.

Dr. Maisterrena mentioned that some of these patients had leukocytopenia and lymphocytopenia but are now recovering. He informed me that the  $^{60}\text{Co}$ -source (or what is left of it) is back in the warehouse or in the clinic and that everything is under control and all the rebar which showed a meter reading of 5 mR/hr at contact (0.5 to 30 mR/hr range) is secured. He suggested that we meet with Dr. Hector Iturriaga, Assistant Director Clinica #79 Instituto Mexicano Seguro Social.

Later on February 14, Dr. Bill Bibb (ORO, DOE) called me and gave the okay for REAC/TS staff to go to Juarez. Dr. Maisterrena was informed of this decision on February 15, 1984.

On February 16, Mr. Lubenau, NRC, Division of Compliance, upon request by Mr. LeFleur called to give me additional background information. (I am only reporting on additional information I have not mentioned in the report so far.) He reported that a warehouse employee who picked up scrap had disassembled the source, accidentally breaking the sealed-off area that held 6000  $^{60}\text{Co}$  pellets. Each pellet measures 1 mm in diameter, weighs less than 8 mg and has an activity of 70 mCi. The outer shell of the pellets can oxidize and is degradable and thus the damaged source contaminated the pick-up truck and poses a problem with regard to incorporation. Mr. Lubenau told me that a 16-year-old young man is likely to have received the highest dose. He worked at the weighing station of the junkyard where in some places the readings were 600 R/hr four inches above the ground and 100 R/hr one foot above the ground. In addition to the patients who were exposed to the radiation externally, some of the workers at the foundry in Chihuahua may have inhaled  $^{60}\text{Co}$  contaminated fumes and the waterwash on the foundry has been found to be contaminated (0.04 R/hr). One important aspect of the problem is the fact that the contaminated truck had been parked, for two months, one meter away from an occupied home. Readings on the truck were 50R/hr on one side and 8 R/hr on the other side (one meter away from the truck). There were children playing in and around the truck.

Mr. Lubenau pointed out that we have two health physics issues on the U.S. side of the problem. First, the possibility of  $^{60}\text{Co}$ -pellets being brought into the U.S. (inadequate monitoring for radiation at the border-commercial trucks only). Supposedly all the contaminated rebar is being returned to Mexico. There is only one disposal site for radioactive materials in Mexico (Mexico City). Another disposal site is planned for Juarez. The contaminated truck has been moved into a ditch and covered with dirt. Now they want to dig it out again and cover it with two layers of lead and concrete.

The second area of concern for the U.S. is assurance for adequate monitoring of the area and the handling of the rebar that has been shipped back to Mexico. Mr. Lubenau hopes that Roberto Trevino would agree to have

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another monitoring flight over El Paso and Juarez. The Mexicans have been offered help repeatedly by Mr. LeFleur (NRC) and Dr. Leo Wade (H.P., Galveston, Texas), but Mr. Trevino did not take advantage of these offers.

Mr. Lubenau suggested that I contact Mr. Greg Yuhas, also a former REAC/TS course participant, for additional information. Mr. Yuhas, who did surveys in Juarez during the week of February 6, recommended contacting REAC/TS for help in evaluating the doses for the people involved.

I asked Mr. Yuhas what is being done to reduce the radiation exposure to the people, and he replied that some of the sources have been recovered and removed, others have been shielded so that the radiation levels in the homes next to the junkyard are now 0.3 mR/hr inside. The radiation levels on the roofs are still 15 mR/hr. According to Mr. Yuhas the whole problem and its potential impact became known to the people in Juarez on January 20, 1984. We discussed recommendations to be considered such as chromosome analysis on all persons with suspected doses of greater than 50 rem, medical evaluation of most seriously exposed persons, follow-up on release of  $^{60}\text{Co}$ -fumes in foundries (whole body counting, environmental surveys) and special attention to the El Paso, Texas, border problem.

On February 16, Dr. Lushbaugh and I talked with Mr. Enrique Fernandez Diaz (Mexico City Health Department). He recommended that Dr. Juan Rauda (Juarez Health Department) would be a good contact. I also talked to Dr. Estrada (Mexican Health Ministry, Mexico City) who asked me to share any relevant and important information and findings with him when we have completed our investigation.

With this background information available to us, we prepared for our trip to El Paso and Juarez. Our team consisted of Dr. Myles Cabot, a biochemist (translator and interpreter), Mr. Eugene Joiner, cytogeneticist, and myself as the physician.

## (2) Activities and Accomplishments in El Paso/Juarez

After our arrival at the hotel in El Paso at 1 p.m. on February 17, 1984, I tried to contact various people in order to find out where and when our meeting with Dr. Maisterrena and the others should take place and where we would find the patients. Nobody seemed to know the answers, and we finally took a cab to Juarez and went to two of the Social Security Clinics (Centro de Salud, Dr. Luis Estravillo Munoz, and Social Security Clinic No. 79) trying to find out about any arrangements. We finally managed to get a message to Dr. Iturriaga who later on that evening had someone inform me that we would meet at the Social Security Hospital No. 35, Valentin Fuentes, at 9 a.m. on February 18.

The late El Paso TV-news reported that the  $^{60}\text{Co}$ -source had been found in Juarez, secured, and would temporarily be stored nearby at the local prison. It sounded like part of the problem had been taken care of.

On February 18, we, Myles Cabot, Gene Joiner, and I, arrived on time for our meeting at the Social Security Clinic No. 35, a large outpatient medical center located at the north-east outskirts of Juarez. I was much impressed by large hallways and large, almost empty rooms. We were hurriedly

ushered by a hospital security guard to the meeting room (Dr. Iturriaga's office and a small conference room).

Present at the meeting were Dr. Jorge Maisterrena (Mexico City, he was leading the meeting), Dr. Hector Iturriaga (Juarez), Dr. Carlos Armendades (Mexico City), Dr. Santos Galbadon Ramirez, a pediatrician from Juarez, Dr. Aguirre, a hematologist who is taking care of the patients at Juarez, Dr. Carlos A. Porras, Director Centre de Salud "B" (standing in for Dr. Rauda), Myles Cabot, Gene Joiner, myself and two or three other people who were not introduced to us (name tags would have been helpful).

In addition to those people, two of the patients were also in the room and were being examined by some of the physicians present. I took some photographs of the men's feet and hands. Nobody seemed to be in charge of the meeting. Finally I asked Dr. Maisterrena whether I could explain to the group what the purpose of our visit was. He gave me permission and I told the group that we have to address two problems: the patient's need for accurate dosimetry and possible medical care and the public health and health physics aspects of the accident. I emphasized that this is probably the biggest radiation accident in recent years, involving more people than in any radiation accident in the Western Hemisphere. We have the responsibility to take care of the patients and to provide for the safety of all the people that might eventually be exposed to radiation if the situation is not brought under control as soon as possible. There was not much of a reaction to my pep talk, and I and my colleagues from Oak Ridge felt some tension between the federal people of Mexico City and the local Juarez people. I also had the feeling that these people did not reveal to us all they knew about the accident. Dr. Maisterrena seemed to agree with everything I said. In the meantime two more patients had entered the room. At this time I suggested to the group that I would examine each patient in a medical treatment room and take blood samples for chromosome analysis.

Myles Cabot, Eugene Joiner and I separated from the group to obtain the patient's personal and demographic data, the blood samples for the chromosome analysis and to do the physical examination. We had offered informed consent forms (translated into Spanish) for obtaining permission to do the examinations, obtaining blood samples, and using the resultant data for publication and educational purposes. Dr. Maisterrena replied that informed consent was not required in Mexico. Dr. Galbadon assisted me with the physical examinations and provided me with copies of the medical records of the patients. The physical findings were essentially unremarkable but evaluation of the medical records revealed evidence for significant suppression of the bone marrow as documented by the hematologic indicators, the recorded spermiograms and a history of epistaxis and bleeding from the gums in two of the men. The four patients I examined were, according to the laboratory findings, recovering from the radiation-induced pancytopenia. A "fifth patient" was being examined in the conference room during the Oak Ridge groups' absence. When later questioned on the i.d. of this patient, no helpful comments were given. The Juarez group did however examine and take photos of what may have been the 5th high exposure patient. Of course one has to realize that the evaluation of a patient exposed to intermittent protracted radiation is not as clear-cut or easy as evaluating patients after single, acute high dose exposure. Likewise, chromosomal changes following intermittent exposure to

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ionizing radiation have not been clearly worked out in terms of a dose-effect relationship (the results are likely to give an underestimated value for the dose). I was not too much impressed by the skin lesions on the hands or feet of two of the men. They were not the ulcerating, necrotizing lesions one would expect after extremely high dose radiation exposure. Rather I saw only hyperpigmented spots on the palms of the hands or the soles of the feet and discoloration of the nailbeds in one of the patients. This finding would be compatible with rather small epidermal doses of 600 to 1200 rad to cause visible erythema followed by hyperpigmentation. I could not get any information on previous erythema. Also, I did not see evidence of hair loss on the fingers or toes. The distribution pattern of the hyperpigmented spots in the skin of the palms and the soles of the feet is hard to explain. Perhaps touching contaminated material or having  $^{60}\text{Co}$  pellets moving around in the shoes of these people could account for these very localized lesions. Notwithstanding the ambiguity of the skin lesions, the information obtained on these four men indicated a significant total body exposure to ionizing radiation.

We rejoined the group at about 12:30 p.m. Somehow the atmosphere had changed and I felt the group was more receptive to my suggestions as to what else to do. I told them that we need to examine and do chromosome studies on some of the "low-dose" people, at least two of the 15 children who had played in the contaminated truck, a pregnant woman (the junkyard secretary in her 3rd trimester), two additional neighborhood children and two more adults who were living further away from the junkyard. I also mentioned the need for a long-range medical follow-up program for all of the exposed persons and possibly an appropriate control group. We were told that the total number of low-dose people is 100. They have a medical record for each of these persons. I requested a roster of all those persons. Dr. Aguirre said they had done white blood cell counts on those 100 people. The counts were all normal. The lowest count was  $4000/\text{mm}^3$ . I thought the latter person should also be included in the chromosome study. I asked what their plans were with regards to remonitoring the area from the air. They felt no great need for it and stated the contaminated areas (the junkyard and the truck) have already been determined. I also wanted to examine the family who is living in the house next to which the contaminated truck was parked. According to Dr. Porrás, however, the truck did not stay at one place for two months but was moved up and down the street by the people. Apparently no one wanted to have it parked in front of their house. I asked about monitoring highways, soil and water in and around the junkyard and the foundries. There are no definite plans to do this at this time. We were told that the "source" or what is left of it would be removed from the junkyard on February 18.

### (3) Summary of recommendations

Finally I summed up my recommendations for the group as follows:

1. Identify as many exposed persons as possible:
  - a) determine the dose by physical and biological dosimetry (chromosome analysis)

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- b) determine the need for medical treatment
  - c) set up a complete roster of the exposed persons and plan a prospective long-range follow-up study.
2. Identify contaminated areas:
- a) in Juarez
  - b) in other places in Mexico
  - c) monitor border exits
  - d) establish an acceptable disposal site for radioactive waste
  - e) clean up.
3. Special considerations:
- a) attention to children and pregnant women
  - b) examine foundry workers for incorporation of  $^{60}\text{Co}$  by whole body counting and radioassays of feces and urine.

Dr. Maisterrena could not give me assurance that these things would be done but indicated he would relate this information to the people in the Commission in Mexico City. He requested that all official reports and final recommendations be sent to Ing. Roberto Trevino, Secretario Tecnico de la Comision Nacional de Seguridad Nuclear y Salvaguardias (CNSNS) in Mexico City. Dr. Maisterrena also requested literature on dosimetry by chromosome analysis which will be provided by Eugene Joiner.

In summing up, I told the group we would complete the chromosome analysis as soon as possible, and we are ready to examine the next group of persons (and also the fifth high-dose patient) as soon as they make the decision and set a date for the examination. I emphasized again how important it is to pay immediate attention to the public health issue, environmental monitoring, etc., and assured them that they could get all the help, equipment and personnel from the U.S. if they request assistance.

At the conclusion of the meeting I asked whether we could see the junkyard. Dr. Maisterrena had no objection but was not inclined to accompany us (neither was anybody else). We left the clinic and took a taxi to go to the junkyard. The driver had some problems finding the junkyard, so I decided to turn on the Geiger counter I had with me. It was the screaming noise from the Geiger counter that finally led us to the junkyard "Phoenix." We took some readings from where we were standing in front of the junkyard: 3 mR/hr to 30 mR/hr, depending on the distance (approximately 150 ft.) and the wind direction. We saw two "Radioactive Material Placards" attached to the gate. The gate was by no means closed, however, and as I took photos I suddenly recognized through the viewfinder two of the patients I had examined earlier. We stopped them to ask what they were doing in the junkyard. They told Myles Cabot that they had just picked up their last paycheck. It does not seem an easy task to keep things under control in Juarez. There were quite a few people, inclusive of local TV and radio personnel in front of the junkyard. We were told the "source" was to be removed later that afternoon. We returned to the motel and airport at 4 p.m. I tried to reach Dr. Porras (Public Health Officer in Juarez) by phone to tell him about the radiation

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levels we had detected at the junkyard. I also wanted him to arrange for all necessary precautions at the junkyard in order to avoid anymore mishaps or another accident when removing and transporting the source. I could not reach him.

My overall assessment of the situation is that (a) this was a serious radiation accident affecting perhaps as many as 200 persons, (b) the physicians, health officials, and the CNSNS do need assistance, (c) there is a remarkable unawareness of the magnitude of the problem, (d) nobody seems to want to take charge and the responsibility, (e) the contamination problem is not under control and continued unnecessary exposure of people is likely, and (f) the patients we talked with seemed to have little or no knowledge about radiation and consequences of radiation exposure. They asked if we could "cure" them in the United States.

We appreciate having been given the opportunity to evaluate the <sup>60</sup>Co-problem in Juarez and to examine four of the people involved. Our Mexican colleagues and the public health people were cooperative and helpful. I would also like to acknowledge the very valuable assistance given to me by Dr. Myles Cabot and Mr. Eugene Joiner. Without their help the mission would not have been successful.

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