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Centers Settle Into New Home, Face Old Problem: Five May Lose Grants, No Reprogramming Seen

The long awaited move of NCI's Cancer Centers Branch out of the Div. of Cancer Prevention & Control, an action for which center directors had argued over the past three years, was consumated at the recent meeting of the Board of Scientific Counselors of the branch's new home,

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In Brief

Schweitzer ACS President, Dodd President Elect; FDA Commissioner Resigns Abruptly

ROBERT SCHWEITZER was elected national president of the American Cancer Society at the society's annual meeting last week in Miami Beach. Schweitzer is associate professor of clinical surgery at the Univ. of California (San Francisco) and medical director of the Cancer Education Prevention Center at Merritt Hospital in Oakland. **GERALD DODD,** head of radiology at M.D. Anderson Cancer Center, was elected president elect. . . .**FRANK YOUNG,** FDA commissioner for the past five years, suddenly announced his resignation this week to take a senior post created for him in HHS, deputy assistant secretary for health, science and the environment, effective Dec. 18. During his tenure at FDA, the average approval time for life-saving drugs dropped from 7.1 years to 4.7 years. Also during that time, tensions between FDA and NCI improved considerably. . . . **MEDAL OF HONOR,** the American Cancer Society's most prestigious award, was presented to Alfred Knudson, senior scientist at Fox Chase Cancer Center, and Ernst Wynder, president of the American Health Foundation. . . . **ACS DISTINGUISHED** Service Award went to Henry Pitot, director of the McArdle Laboratory for Cancer Research, and Helene Brown, codirector of the Div. of Cancer Control at UCLA Jonsson Comprehensive Cancer Center. . . . **CANCER RESEARCH** Institute this week presented the William B. Coley Award for distinguished research in immunology to Howard Grey, vice president for research and development of Cytel Corp.; Alain Townsend, lecturer in immunology at the Institute of Molecular Medicine, Univ. of Oxford; and Emil Unanue, chairman of the Dept. of Pathology, Washington Univ. School of Medicine. . . . **BRENDA SHANK** was appointed chairman of the Dept. of Radiation Oncology at Mount Sinai Medical Center. . . . **ELIZABETH THOMPSON** has been named physician in chief of St. Jude Children's Research Hospital, Memphis. A 15 year veteran of St. Jude's hematology-oncology division, Thompson recently served as director of the hospital's After Completion of Therapy Clinic. Hospital Director Joseph Simone said Thompson's appointment ends a year long search.

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the Div. of Cancer Biology & Diagnosis.

The "move" did not involve shuffling of office space--the branch remains in the Executive Plaza North quarters where it operated in DCPC. The organizational change is significant, however, even if a lateral move to DCBD was not exactly what the centers had in mind.

Instead of a new division for the centers and NCI's other resources programs--organ systems, facilities (construction and training)--the branches administering those grant supported extramural activities are now located in the new Centers, Training, & Resources Program of DCBD. Brian Kimes has moved over from his old position as DCBD associate director in charge of the Extramural Research Program to AD for the new program.

Kimes returned to NCI Nov. 1 from temporary detail to NIH as acting director of the new Office of Scientific Integrity.

The DCBD board was jolted early in its first meeting since expansion of its mission when NCI Director Samuel Broder pointed out that nearly 10 percent of the existing 58 funded cancer centers may lose their core grants during the current fiscal year. Broder said that the across the board sequestration of five percent required by Gramm-Rudman to meet the deficit reduction target will result in cutting the centers budget by $5 million.

Core grants are being funded at 85 percent of recommended levels, and Broder indicated they probably would not be cut further. If that line is held, the shortfall would leave unfunded at least five centers whose grants are being recompeted this year. Any new centers competing successfully this year could add to the number of existing centers left without core grants.

Board Chairman Arnold Levine asked Broder if he has any latitude in reprogramming NCI funds.

"Some, but that reminds me of the emergency room worries about brain perfusion versus kidney perfusion," Broder said. With every other program area at NCI suffering from budget cuts, and with less than 20 percent of approved competing RO1 grants due to be funded, it is not likely any money will be reprogrammed into centers.

The best hope for centers and other NCI programs is for Congress and the White House to agree on budget reconciliation which would meet the Gramm-Rudman target without sequestration.

Broder mentioned the possibility that some money might become available for construction and renovation of research facilities through NIH. "We have grants peer reviewed and ready to go," he said. "We're ready to compete for NIH construction dollars."

DCBD Director Alan Rabson pointed out that the NCI construction budget this year "in round numbers, is zero." He said the Research Facilities Branch would be kept intact despite that and the retirement of long time branch Chief Donald Fox.

Rabson had agreed to add three center directors to the DCBD board, which traditionally had been made up primarily of basic scientists. Two of those members, not yet formally appointed to the board, were present as guest speakers--Ross McIntyre, director of the Norris Cotton Cancer Center, and Walter Eckhart, of Salk Institute. A third will be named later, and all three probably will be appointed before the board's winter meeting.

The board was not without center representation otherwise. Other members from cancer centers are Vittorio Defendi, director of the New York Univ. Cancer Center; Margaret Kripke, chairman of immunology at M.D. Anderson Cancer Center; Richard Metzgar, professor of immunology at Duke Univ. Comprehensive Cancer Center; and Carolyn Whitfield, associate professor of biochemistry at Howard Univ. Cancer Center.

With the three additional center directors, that gives centers seven of the 14 seats on the board.

Kimes told the board that dilemmas facing cancer centers have been handled by NCI, "In my observation, haphazardly." He added that comprehensive centers have been "a club" with very limited membership. "Dr. Broder is reversing this.

"In the past, we have not involved centers in the planning process. I think what will come out (of the

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Editor: **Jerry D. Boyd**
Associate Editors: **Kirsten B. Goldberg**
Patricia Williams
Editorial/Subscriptions Office
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changes) is a powerful partnership."

The 1978 reorganization of NCI by then Director Arthur Upton included two fundamental errors, Kimes said. Prior to then, all grant supported extramural research was administered out of one division. The other divisions were limited to contracts and the small and highly targeted Cancer Research Emphasis Grants for their extramural research.

"They never figured out what to do with the resource programs," Kimes said. "They went to DCPC, but there was no logic for their placement there. I don't know what that rationale was."

Also, "We never created ways to encourage cross talk. We had a vertical structure, with little cross communication. It was easier to talk about common activities with another institute than with another NCI division."

A centers planning committee includes representatives of each division and is chaired by NCI Deputy Director Maryann Roper. An ad hoc advisory group of center directors is involved in the planning process. Kimes added that the Assn. of American Cancer Institutes is a valued advisor.

Among issues being considered by planners are how center networks can be developed, working with NCI to take advantage of new opportunities; determine what the optimal number of centers should be; what should the balance in numbers be among basic, clinical, and comprehensive centers.

"I think there will be some carrots for comprehensive centers, maybe first crack at new drugs and high priority clinical trials," Kimes said.

"There is no doubt the opportunities are there. There is no doubt that we will have to make compromises. Sam (Broder) says that is why we get paid big bucks, to make big decisions."

Kimes' most immediate problem is rebuilding the centers staff. Margaret Holmes has been named acting chief while recruitment of a permanent chief is carried out. Kimes said he is looking for someone with "a medical background, energy, and vision, who sees the relationship of basic and clinical research."

McIntyre said that a few years ago, "I realized the NCI director's view of cancer centers was changing. That was when Vince (DeVita, former director) pointed out that in Los Angeles, which has two comprehensive cancer centers, women still died of cervical carcinoma, a preventable disease. That made me shiver. This was clearly a public health problem, and to expect centers to address the problem was a new view of centers." That is the view of Congress, McIntyre added.

"The view of the legislative branch is very different than the view of we who are trying to get grants renewed," McIntyre continued. "The best science vs. public health."

Citing recent reduction in New Hampshire's cancer mortality, McIntyre said that "it is hard to concluded that the Norris Cotton Cancer Center had nothing to do with that decrease."

McIntyre said that center core grants support the "scientific infrastructure," a concept developed by Palmer Saunders when he was director of what was then the Div. of Research Resources & Centers. He called Saunders a "visionary" who determined that interdisciplinary research would be enhanced by some reasonable support of the infrastructure and shared resources.

"Clearly, what the program needs is leadership that understands what centers are supposed to do and can do," McIntyre said.

Eckhart supported McIntyre's points and added that "core grants allow you to bring together outstanding people to focus on a problem. At Salk, many things would not have been done without it."

Eckhart said that Salk, a basic research center, interacts with two other centers in its region, the Univ. of California (San Diego), which has a clinical cancer center; and the La Jolla Cancer Research Foundation, which is another basic research center. "We also have a unique relationship with the Fred Hutchinson Comprehensive Center."

Responding to the question, "What do you see as the major need in the centers program?" Eckhart said, "More money. Other than that, center directors who can find and train the talent to work together on scientific problems."

McIntyre said the major problems are the budget "and the decimated centers program staff, which has led many of us to feel that the centers program has been downgraded by NCI."

New Criteria For Comprehensive Center Recognition Wrapped Up

The process of renewing and revitalizing NCI's recognition of comprehensive cancer centers has almost been completed. It should soon result in the first addition to the number of comprehensive centers in 10 years, and possibly to the loss of such recognition by some.

Two major changes in the process have been pretty much agreed upon:

▸Recognition as comprehensive will depend on peer review of how well a center meets the eight criteria established for comprehensiveness, to be conducted at

the time of review of the center's core grant. Review for comprehensiveness will be carried out by the same group which reviews the core grant, the Cancer Center Support Grant Review Committee. This review will be carried out every time the core grant is reviewed.

The existing 20 comprehensive centers were accorded that status after review by a committee of the National Cancer Advisory Board, using a list of 10 general characteristics as guidelines. Many of the centers were given comprehensive status without meeting all the characteristics. Recognition as comprehensive was given for an indefinite time, with a new review triggered only when a center failed to get its core grant renewed. No center ever lost its comprehensive status through review.

▸A new, eight point list of criteria which sets forth more precisely and more firmly the criteria expected of a comprehensive center.

Review guidelines have not yet been completed. A draft of those guidelines has been sent to center directors and members of the National Cancer Advisory Board for their comment. The draft guidelines instruct reviewers to approve a center for comprehensive recognition only if it meets all eight of the criteria.

The draft provides that centers whose grants will not be up for renewal within two years may ask for a separate review prior to then.

NCI is still soliciting comments on those and the rest of the proposed guidelines. They will be discussed again at the NCAB's next meeting, in December. The draft guidelines will be published next week in **The Cancer Letter.**

The eight criteria have already been approved by the NCAB; in development for nearly two years, they should be considered as final, at least until they have been tested for a few years.

Criteria No. 8, which NCI Director Samuel Broder said "is back to the future," has been worrisome to some center representatives. That is the requirement for community service and outreach.

Broder told the Div. of Cancer Biology & Diagnosis Board of Scientific Counselors that "One of the first things Congress wanted" in the National Cancer Act of 1971 was community service and outreach by centers. "There is no question in my mind that Congress had those expectations."

Following is the complete list of eight criteria:

1. **Basic Laboratory Research:** A critical mass of integrated personnel, laboratory facilities, and financial support for basic research is essential. The center should promote interdisciplinary interactions between scientists engaged in cancer research, including critical collaborations between basic and clinical investigators. A significant portion of research support should be from sources that utilize peer review.

2. **Basic/Clinical Research Linkage** (Technology Transfer): A center should facilitate the transfer of exciting laboratory discoveries into innovative clinical applications, including clinical treatment and prevention. Further, once a unique opportunity is identified, a distinguishing feature of comprehensive cancer centers is the ability to stimulate interactions either as basic/clinical collaborative research within the center or as collaborative research between elements of the center and other organizations, e.g., research institutions or the biotechnology industry.

3. **Clinical Research:** A clinical research program utilizing patient resources of the institution and its region is essential. Ideally, such studies involve relevant center laboratories as well. A center should be a major source of innovative clinical studies which can later be exported, e.g., to clinical cooperative groups or into general medical practice.

4. **High Priority Clinical Trial Research:** There exists a critical need for expeditious completion of clinical trials of major importance. In order to address this problem, centers should play a leading role in clinical trials when high national priority is identified by a mutually satisfactory process involving the centers and NCI and when better competing hypotheses are not available. Although a center may not enter patients in every trial so identified, it is expected that every center will contribute significantly to the National Cancer Program as a whole.

5. **Cancer Prevention & Control Research:** Cancer control is the reduction of cancer incidence, morbidity, and mortality through an orderly sequence from research on interventions and their impact in defined populations to the broad, systematic application of the research results. The center's plans may relate to any or all phases of cancer prevention and control research. A comprehensive center should develop linkages with appropriate organizations to move toward the demonstration phase when it is feasible and opportune. Involvement in cancer control on a regional and national basis, if funds were available, would be required in competing renewal applications. As with other areas of research, comprehensive cancer centers would be expected to have peer reviewed research in cancer prevention and control. Cancer prevention and control research also includes epidemiologic research and research on cancer etiology in humans.

6. **Education, Training, and Providing Updates on Current Technology:** It is essential that the center be

a focal point for research training and for continuing education for health care professionals locally and within the region. In addition, the center should offer training in state of the art technology (procedures or instrumentation) to the extent of its capabilities. An important additional part of this educational effort would be to establish programs to train new investigators in cancer prevention and/or control research.

7. **Information Services:** The comprehensive center should have an established patient education program and the ability to provide patients and their families with up to date information on local as well as national resources that may be needed. In addition, the center should participate in a Cancer Information Service in the area, giving accurate information on cancer prevention, diagnosis, treatment, and rehabilitation to patients, the public, and health professionals. Through the CIS (or center staff) each center should heighten public awareness of the importance of participation in prospective clinical trials.

8. **Community Service and Outreach:** It is essential that a comprehensive center should define the community it serves and maintain productive outreach efforts in that community. A comprehensive center should take steps to identify cancers of high frequency within the community it serves and carry out appropriate cancer prevention and control activities for such cancers. In addition, comprehensive cancer centers should conduct programs of cancer prevention and control activities relevant to the needs of populations within the community with disproportionate cancer incidence and death rates (e.g., minorities, people over 65, etc.).

FDA Doing 'Less Of Everything,' Needs To Set Priorities, GAO Says

FDA desperately needs additional staff, funds and office space, but the agency needs to conduct an assessment of its priorities before Congress can address the problems, a report by the General Accounting Office says.

"FDA is experiencing resource problems that may affect its ability to fulfill its legislative mandates," said Mark Nadel, associate director for national and public health issues at GAO. Those problems have an effect on the amount of time it takes for drugs to get FDA approval, Nadel told a meeting last week of the National Committee to Review Current Procedures for Approval of New Drugs for Cancer and AIDS, also know as the Lasagna Committee after its chairman, Louis Lasagna.

Since 1980, Congress has enacted over a dozen new laws that increased FDA's responsibilities, Nadel said. However, FDA's staff has decreased from 7,816 in FY 1980 to about 7,229 in FY 1989, about a 600 person decrease, or 8 percent.

Additional responsibilities resulted from FDA's role in research, development and approval of products for AIDS treatment and prevention. Even though Congress made additional appropriations to FDA for AIDS, the agency has spent more than anticipated. For example, in 1988, FDA devoted more than twice as many staff years for AIDS work as it received funding to support.

"The Center for Drugs spent 19 more staff years for AIDS than was funded," Nadel said. "For fiscal year 1989, FDA estimates it devoted 77 more staff years for AIDS work than had been provided for by its fiscal year 1989 appropriation.

NDA Review Takes 31 Months

"In regard to reviewing new drug applications, FDA maintains that staffing shortfalls, particularly in the number of medical officers, have delayed its reviews, which are taking about 31 months--five times longer than allowed by law."

A 1984 FDA task force report found that FDA program managers were faced with the dilemma of increasing demands for services and less resources. "The strategy for coping with this situation was often to do less of everything rather than stopping anything," Nadel said. FDA officials told GAO that the same situation exists today.

According to the GAO report, which was requested by two Senate committees, FDA says it needs more than 2,000 additional staff to replace those lost since 1980, to fully implement new legislative requirements and to handle responsibilities related to AIDS.

However, this estimate was based not "on a comprehensive assessment of current and future staffing needs, but on information compiled from the judgmental estimates of senior FDA officials." FDA has not performed a comprehensive staffing assessment since 1975. At that time, the agency projected a staffing need of 9,000 by 1982, or about 1,800 more than it currently has.

FDA does not have a method for routinely recording staff time, which is necessary to determine workload and productivity, the GAO report said.

A comprehensive staffing assessment also should consider prioritizing the agency's activities to see if some activities could be decreased or eliminated, the report said.

Staff recruitment and retention has been a major problem at FDA, particularly senior level staff and

medical officers, the GAO report said. During the last six years, it has taken from four months to five years to fill 36 senior level positions. The position that was vacant for more than five years was the division director in the Center for Drug Evaluation and Research. The report said disparities in pay between the federal government and the private sector was hampering recruitment. From 1985 to 1988, FDA lost from 18 to 22 percent of its medical officers each year.

The turnover rate for medical officers can translate into significant delays in the drug review process because of the length of time it takes to fill a position and train a new reviewer, and the loss of full capability in a particular drug specialty when the sole reviewer in that area leaves, Nadel said. Besides pay disparities, lack of scientific recognition and job dissatisfaction are factors in the high turnover rate.

"The impact of FDA's personnel recruiting and retention problems may worsen over the next decade as about three-fourths of FDA's senior staff will become eligible to retire," Nadel said.

In addition to staffing problems, FDA suffers from acute space shortages, the GAO report said. FDA says it needs about $500 million to upgrade its headquarters and additional funding to upgrade its laboratory equipment, but again, the estimate is based on only cursory assessments, the GAO report said.

Nadel and other GAO staff toured facilities of FDA's Center for Drugs. "Staff at all levels, including medical doctors and PhD pharmacologists, statisticians and chemists were working in small, crowded offices. The crowded working conditions were made worse by the need for center staff to handle the voluminous materials that are sometimes submitted with drug applications."

The report included photos of some of the small, closet like offices. "In some cases, offices were so cramped that doors could only be partially opened," Nadel said.

The GAO report recommended that Congress require the FDA commissioner to make an agencywide assessment to identify and prioritize its activities and responsibilities.

The GAO report said FDA should:

▸Assess its responsibilities and the staffing requirements to meet these responsibilities based on present and future projections.

▸Determine the activities it can effectively undertake given a specified level of staffing increases.

▸Identify the management changes it would implement to match specific staffing levels with higher priority responsibilities.

Committee member Charles Leighton asked Nadel if it was realistic to expect FDA to list some activities as low priority, given the political pressures on the agency. Nadel said it would take "continued dialogue with Congress to insulate FDA from pressures."

"What could our committee do to help implement these recommendations?" Leighton asked.

"I hope they would be reflected in your report--the idea that drug approval does not exist in a vacuum," Nadel said.

Committee member Gertrude Elion noted that the problem of recruiting medical officers could be ameliorated if FDA created outside expert advisory groups to approve single applications in a particular field. This approach is used extensively in Europe, she said. She also suggested that FDA could contract out some of its laboratory work.

"In any assessment FDA does of its priorities, that should be part of it," Nadel said.

Elion commented on the size of FDA applications, "often truck loads of material," and suggested that parts of the applications should not have to be submitted, but made available on demand.

Committee member Peter Hutt asked whether FDA could carry out these recommendations without seeking changes in the law. Nadel said a study of its resources and priorities "should be well within" its mandate.

"Why couldn't the GAO do (a study)?" Hutt asked. "You people have enormous expertise and provide credibility."

Nadel said when GAO began this report, "We thought we would be able to give specific recommendations," but wasn't able to because FDA "did not have systems in place and could not provide us with necessary data" on its activities and the time it takes.

This kind of study would best be done by a contractor, Nadel said.

John Petricciani, vice president for medical and regulatory affairs of the Pharmaceutical Manufacturers Assn., told the committee that industry believes that, "FDA has drifted far from the basic intent of Congressional legislation and that significant revisions are needed to help the agency comply with existing law and meet the growing expectations of the public: namely, to get new drugs onto the market within 180 days of an approvable application."

Petricciani said FDA should stop requiring the standard IND filing for phase 1 studies that are not directly related to drug development, what FDA calls "research" INDs.

This would free some resources for processing NDAs, he said. If this deregulation were to take place,

institutional review board and informed consent requirements would remain in force to assure that human subjects are protected, he said.

Hutt said critics of a program to deregulate phase 1 say that a pilot project would involve only top class universities, "so it would be guaranteed to succeed. What happens when you expand the program to Podunck U.?"

Jere Goyan, dean of the school of pharmacy at Univ. of California (San Francisco) and a former FDA commissioner, said he supported the PMA proposal. "In cancer, there has been excellent research by community physicians." Community physicians may be more inclined to follow protocols, while university researchers "always want to improve things," he said.

Hutt noted some institutions may not want to participate in such a system. Petricciani said a pilot system could be optional. Hutt asked Goyan, "Don't you think that once this becomes operational, that researchers would want to strengthen their IRB to have more control themselves over the research? There would be an incentive to do a better job."

Institutions "may see this as putting them at greater risk of lawsuits" if they approve studies, Goyan said, "whereas if FDA approves it, it gets them off the hook."

Goyan told the committee that FDA's purpose is "to keep bad drugs off the market, not to get good drugs on the market. It's hard for a regulatory agency to have a double standard."

Goyan suggested less emphasis on hypothesis testing. "The sponsor spends $20 to $30 million up to phase 2 and is going to spend more, and you expect them to assume this drug is no better than a placebo." He said data is merely "thrown away" if research is not done under a randomized clinical trial.

Board member Emil Frei noted that Goyan's approach would put a greater emphasis on well conducted phase 2 studies.

"You know at the end of phase 2 if it is effective, phase 3 just fills out the label," Hutt said. Hutt added that AIDS activists criticize the current drug approval system for having no way of accommodating unorthodox therapies. During the laetrile controversy, FDA's actions "convinced many states to legalize it and thousands of Americans to go to Mexico to get it."

Goyan, who was commissioner of FDA at the time, said the decision to approve a trial of laetrile "was one of the better decisions I made. I believed it had to have a hearing. It was allowed to go on trial and it showed no result." Perhaps as a result, he said, laetrile "is not near the problem today" as it was in the 1970s.

I-131 Doses Highest Near Test Site In Nevada, Idaho, NCI Study Finds

An elaborate study nearing completion in NCI's Div. of Cancer Etiology will provide tables of data that will enable any individual in the U.S. to determine the probable dosage of iodine 131 he or she might have received as a result of fallout from above ground nuclear weapons tests in Nevada in the 1950s and early 1960s.

Persons living nearest the test sites were at greater risk of receiving higher I-131 doses directly through inhalation or by drinking cow's milk. However, fallout was carried across the country and affected many areas, Bruce Wachholtz, chief of the Radiation Effects Branch, told the DCE Board of Scientific Counselors at its recent meeting.

Wachholtz discussed the general pattern of I-131 dosage across the country, but did not provide specific doses. The study is in the phase of uncertainty analysis and should be completed by the end of next year, he said.

There were 663 weapons tests at the Nevada test site as of the early part of this year. Over 500 of those were conducted underground, in which there was no release of radioactive material. The other 163 had some detection of material on site. The NCI study analyzed 88 of those tests, which constitute 98 percent of all of the iodine released.

A law passed by Congress directed HHS to study the risks of exposure to I-131 due to weapons tests. A complicating factor in the study was that there were no measurements of I-131 in the 1950s, Wachholtz said. PHS began monitoring milk in 1961.

The NCI study was designed to measure, for representative populations, the risks per rad, probable rads of exposure and the exposure across the country. The study provides the methodology by which any individual can determine his or her exposure.

The study broke down exposure by 13 age categories, by sex, by 3,094 counties in the U.S., time, by test, by each day following each test, and by milk consumption. Although I-131 could have gotten absorbed by inhalation and other foodstuffs, cow's milk was the primary concern, Wachholtz said.

Most of the time, tests occurred during the prevailing easterly winds. Monitoring stations across the country in the 1950s and 60s tracked the nuclear cloud. The stations did not monitor I-131 directly, but did measure the total beta activity. From data released by the Dept. of Energy five years ago, which identified the components released test by test, the researchers could reconstruct and calculate the I-131 components

released near each monitoring station. They also relied on precipitation records county by county.

"Deposition maps"--maps of where the I-131 was deposited by rainfall--were drawn. Higher deposition occurred near the Nevada test site, fell off gradually toward the Northeast and to New England. After one test, a heavy rainstorm in the Troy, N.Y., area intercepted the fallout cloud, Wachholtz said. That resulted in a heavy deposition of radionuclide fallout.

"If one takes all of the tests into account over all of the time periods, you end up with an map that shows heavier concentrations in Nevada, the intermountain area, falling off to the Great Plains and the East Coast," Wachholtz said. Very little iodine was deposited along the West Coast.

The next step was to determine how much of the iodine was transferred from vegetation to cow's milk, and then to people. The study split the country into "pasture regions" and researchers talked to dairy farmers in each state to find out when cows were usually put out to pasture. Using that data and a regular federal cow census, the researchers determined the pasture intake, or the average amount of vegetation a cow ingests in each state. They also got an estimate of time integration concentration of I-131 in milk for each test.

The next step was to determine the intake-to-milk transfer, or how much I-131 ends up in milk, which Wachholtz said is "fairly well known" from other studies. The study then generated a map of milk production across the U.S. using milk production records by state and county.

The researchers estimated which counties had "milk surpluses" and which had "milk deficits." As one would expect, there was surplus milk in New England and the upper Midwest. Deficit areas were the Southwest, parts of the Southeast, and the major metropolitan areas.

Next the study traced the milk to the consumer by dividing the country into 400 "milk marketing regions."

Wachholtz showed an example of the study's findings. A deposition map of New England after one test showed that no iodine was deposited in Boston, the New York metropolitan area or Long Island. A map taking into account the transport of milk to those areas, however, shows larger concentrations in those metropolitan areas.

"All this shows is that where the iodine was deposited (by fallout) in many cases was transferred to areas where it was deposited through the milk distribution system of the country. We have done this for all parts of the country, all counties, all tests, etc," Wachholtz said.

The next question was milk consumption, which varies by age, and for adults, by sex. Also, of milk consumed, what is the consequent dose? The study generated dose conversion factors, from fetus to adult.

The researchers conducted representative analyses of a person with average milk consumption, one with high milk consumption, no milk consumption, consumption from "the proverbial backyard cow" (in which milk is consumed the same day it is produced with no time for radioactive decay), and infant consumption of mother's milk. Data on the estimated doses for these groups will be provided for in the report by county, Wachholtz said.

The report will provide "tables, concentrations in the relevant foodstuffs and in the air, for each county, for each day, for each test, by age," Wachholtz said. That data would have to be combined with an individual's personal information such as diet and residence. "Using that, the (dose-conversion) equation, going through each time interval, people should be able to calculate their dose. We will provide examples of how to do that so that an individual can walk his way through the report," Wachholtz said.

Wachholtz provided one example: Thyroid doses of I-131 appear to have been highest in the vicinity of the test site and in Southern Idaho, and then falling off in intensity through the intermountain areas, the Great Plains, and the East. As one would expect, "For a population that does not drink milk, the dose is reduced. For high consumption, there are higher doses throughout the area and across the country."

"If one combines everything, all ages, both sexes, all tests, the highest doses are in the area of the test site and downwind, and in Idaho.

"The obvious question is how good is all this stuff?" Wachholtz said. "There are an awful lot of assumptions, presumptions and so on. The only hard data we've been able to come up with is the fact that the military in 1955 did analysis of urine of military personnel at bases across the country. The samples were pooled. We do not know the source of the milk. We don't know much more than there is a number. That number for the locations involved and the (NCI study's) prediction of what would be in urine at those locations is a predicted over observed of .6 to 22. Most were in the range of .6 to 4. In addition, from autopsies in Tennessee and California, radiological measurements of thyroids, the ratio was 3.6 in Tennessee, and .9 in California.

"Given all of the uncertainties and assumptions and estimates involved in a continental scale analyses, we feel that this is fairly reasonable," Wachholtz said.