

**Acute Myelogenous Leukemia of Marion Woods
Due to
Radioactive Oil Field Pipe Scale from the Harvey Yard**

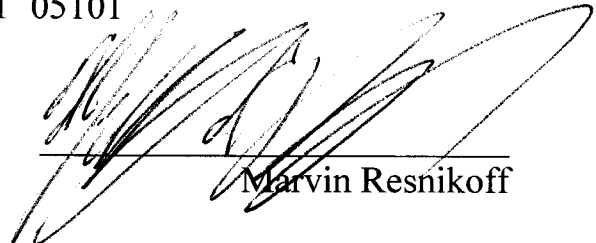
September 30, 2015

Report prepared for the law firm of

Henry Dart, Esq.
510 North Jefferson Avenue
Covington, LA. 70433.

By

Marvin Resnikoff, Ph.D.
Radioactive Waste Management Associates
Box 105
Bellows Falls, VT 05101



Marvin Resnikoff

Marion Woods

Introduction

Marion Woods was born July 21, 1957 in New Orleans, Louisiana. She was exposed without her knowledge, to naturally occurring radioactive material (TENORM) as she resided in the neighborhood of the Harvey pipeyard in Harvey, Louisiana where oil field pipe de-scaling took place. Her residence was quite close to the Harvey Yard. Oilfield pipe scale cleaning operations took place from the 1940's until 1993. She was raised in the neighborhood, at 1219 Paillet Ave, went to the local elementary school one block away, Elm Grove Elementary School, played in the street near the Harvey Yard till she was 14 years old, and continued to live in the neighborhood in her adult years, even after she was married. Her home was not air-conditioned, so the outside air entered the home with fans. She developed acute myelogenous leukemia in 1993.

At the Harvey Yard, there was no radiation protection program. Therefore, no measurements were made at the time the work was performed, so the true radiation doses will never be known. Ms. Woods reported a white dust emanating from the Harvey Yard and this is consistent with scale dust we have seen in Texas A&M videos and reported by numerous ITCO workers. Ms. Woods received radiation dose from several pathways, inhalation being the most dominant. She also reported eating vegetables from a garden and berries from the pipeyard. In addition, deposited dust would give rise to a direct gamma dose. I have reviewed these additional pathways, but they were minor compared to the inhalation pathway, and have not been included in this report for the cancer that Ms. Woods contracted. In addition to calculating her radiation dose, I have also employed the NIH software, IREP, to calculate the likelihood that radiation caused her cancer. As seen, her assigned share is almost 100%, that is, it is almost 100% certain that radiation is responsible for her leukemia.

To prepare this report we reviewed court petitions, deposition transcripts of Ms Woods, previous work in similar cases, and her medical records, and had Counsel ask Ms. Woods several questions. The methodology and data I employed is standard for health physicists, and is, in my opinion, conservative. I take into account Ms. Woods' residence, work time and living conditions. I also employed the previous modeling of air concentrations and particle deposition by Mr. Biggs, and consulted several articles and reference documents.

Since 1992, I have worked on hundreds of TENORM cases and performed radiation risk calculations for clients in personal injury cases in the States of Mississippi, Louisiana, Texas, and Kentucky, including ITCO workers at the Harvey Yard. I have driven around the Harvey yard. I am a graduate of the University of Michigan with a PhD in high energy theoretical physics and am presently the Senior Associate at Radioactive Waste Management Associate based in Bellows Falls, Vermont. My resume is attached as Appendix A. As more information becomes available, I reserve the right to supplement this report.

Radiation Risk Analysis for Acute Myelogenous Leukemia

We calculate the radiation dose rate due to inhalation of radioactive particulates by first calculating the amount of radioactivity that Ms. Woods inhaled per unit time, and then employed standard dose conversion factors (DCF) recommended by the International Commission on Radiological Protection (ICRP)¹. These DCFs convert an amount of a specific inhaled radionuclide into the resulting inhalation dose. The Inhalation rate of a female is different than a male, and is different for an infant. I employed the inhalation rates developed by ICRP² for her Ms. Woods' respective age. The dose conversion factors should also reflect her age; younger persons have more rapidly growing cells. But I used the DCF's for an adult, which serves to lower the dose.³

Different DCFs exist for different exposure assumptions. For our calculations, we assume that the respirable scale dust is relatively insoluble, and that the particles have a diameter of 1 μ m. Dose conversion factors for inhalation are presented in App. A. As scale dust travels from the pipeyard across Paillet Ave, the smaller particles travel a greater distance. In my opinion, 1 μ m is a conservative assumption.

I also assume secular equilibrium between Ra-226 and Ra-228 and their respective progeny, i.e. we apply the same activity in scale (in pCi/g) for the daughter nuclides as for their parents.

The total amount of inhaled radioactive material is equal to the dust loading in the air where Ms. Woods was present, times the radioactive concentration of the dust, times the ventilation rate (breathing rate). The inhalation dose rate can therefore be calculated as follows:

$$DR_{inh} = C * A * V * DCF_{inh}$$

Where:

DR_{inh}	Inhalation dose rate (mrem/time)
C	Air particulate concentration (mg/m ³)
A	Activity of Ra-226 and Ra-228 in scale (pCi/g)
V	Ventilation rate (breathing rate, m ³ /time)
DCF_{inh}	Dose conversion factor for inhalation for Ra-226 and Ra-228 chains (mrem/pCi)

¹ International Commission on Radiological Protection (ICRP), 2001.

² ICRP 66

³ The detailed calculations appear in the associated spreadsheet, Woods, M.xls

We determine both the air particulate concentration and the yearly surface deposition which we use to determine the gamma rate from the calculations by Mr. Biggs⁴ who has calculated these numbers with distance from the Harvey Yard. This is shown in Fig. 1. Biggs employed the EPA ISC air dispersion model, taking into account the location of descaling machines in the Harvey Yard and several years of meteorological data to describe the wind patterns for the site. Exxon-funded studies at Texas A&M shows dust clouds traveling some distance from the descaling machines, lending support to the Biggs report. In addition, it is expected that smaller particles will travel further into the Harvey Yard neighborhood than larger particles. This is of greater consequence for residents who inhale particles. In work I have done for the State of Nevada concerning transportation accidents, larger size particles land closer to the accident scene, than smaller sized particles.

The location of Ms. Woods' residence, 1219 Paillet Ave, from Google maps, is shown on Fig. 2. Correlating these two, we see that the yearly particle deposition at Ms. Woods' residence is 4825 grams/sq meter (g/m^2) and the air concentration is 908 micrograms/cubic meter.

From her birth through age 5, she was at home. Her home had no air conditioning, just fans. So the outside air and inside air are assumed to have the same radioactive concentrations. For the next 6 years, Ms. Woods attended Elm Grove Elementary School at 1121 Paillet Ave, one block from her home at 1219 Paillet Ave, during the school year. She played in the neighborhood. The air concentrations were slightly different at these two locations, and this was taken into account, as was her lung size. Ms. Woods recalled seeing a white dust cloud emanating from the pipeyard. On rare occasions she actually ventured onto the pipeyard to pick berries. There were no fences to prevent entry.

To calculate the radioactivity (A) in the dust, we use a scale activity of $A = 6,000 \text{ pCi/g}$ for Ra-226, and of $A = 2,000 \text{ pCi/g}$ for Ra-228. This estimate is based on measurements by the EPA⁵, Chevron^{6,7} and Reed⁸.

Finally, to calculate Ms. Woods' inhalation, we need to account for the time she was in the neighborhood. This changed by her age. When she was in elementary school, she spent part of the day one block away. In junior high and high school, she was out of the neighborhood 8 hours a day, 5 days a week, during the school year. Then when she was in college and when she was employed, she was out of the neighborhood, 40 hours a week, 52 weeks of the year. Using this information, I calculate the total dose she received by multiplying the dose rate with the exposure time:

$$\text{Dose}_{\text{inh}} (\text{mrem}) = \text{DR}_{\text{inh}} (\text{mrem/time}) * \text{exposure time}$$

⁴ Biggs, Gale, "Air Dispersion Impact Assessment of the Harvey Term Site," W Gale Biggs Associates, P.O. Box 3344, Boulder, CO 80307, January 2005,

⁵ United States Environmental Protection Agency (US-EPA), 1987

⁶ NORM Study Team, Chevron USA, Inc., 1990

⁷ PGREF 101884

⁸ Reed G, Holland B, and A McArthur, 1991

Since Ms. Woods developed leukemia, I calculated the inhalation dose to red marrow. The inhalation doses I calculated appear in Table 1. The details appear in the spreadsheet Woods, M.xls. To repeat, I ignored ingestion dose of garden vegetables and berries, and incidental ingestion due to wiping ones hand over ones mouth. These doses are expected to be less than an inhalation dose.

Gamma Radiation Dose to Red Marrow from Scale Deposition

In addition to an inhalation dose to red marrow caused by inhaling radioactive particles, Ms. Woods red marrow was also exposed to direct gamma radiation from dust deposited on her yard, home and neighborhood, similar to an X-ray machine that cannot be turned off. No radiation measurements were ever taken, so we cannot rely on actual measurements. Again, we work from Biggs' calculation of the deposition of particulates at 1219 Paillet Ave, 4825 grams per square meters (g/m²). We employ EPA tables⁹ to provide red marrow dose, which are added to the yearly red marrow dose due to inhalation. Note we do not add the cumulative deposition from one year to the next. The total yearly groundshine red marrow dose I calculate is 8 rem/yr, assuming a person remained outdoors 100% of the time, which is obviously not likely. Assuming ¼ the time, 6 hours/day, this would be 2 rems/yr in addition to the results of Table 1. As seen, the gamma contribution is much less than the inhalation contribution to the red marrow dose shown in Table 1. I have not added this dose contribution to her inhalation dose.

Risk of Developing Leukemia

To calculate the likelihood that Ms. Woods' leukemia was due to the radiation dose received at the radiation received from the Harvey Yard, I employed the software developed by the National Institute of Health, the Interactive RadioEpidemiological Program (IREP). The equation used in NIH-IREP is

$$\left\{ \begin{array}{l} \text{Probability of} \\ \text{Causation} \end{array} \right\} = \frac{\left\{ \begin{array}{l} \text{Excess} \\ \text{Relative Risk} \end{array} \right\}}{\left\{ \text{Relative Risk} \right\}} \times 100\%$$

The probability of causation is also called the assigned share and is "the fraction of cancers observed in a large and heterogeneous group having similar exposure histories that would not have occurred in the absence of exposure. The excess relative risk is primarily based on Japanese bomb survivor data. I put the Ms. Woods' inhalation dose data into the IREP program. The results are shown in Fig. 4. As seen, at the 99th percentile, the likelihood her leukemia caused by radiation is 97.7%. At the 95th percentile, it is 94.5%. At the 50th percentile, it is 68.8%.

⁹ U.S. EPA 1993

To interpret these numbers, a similar program, NIOSH-IREP, is used by the Justice Department to determine whether Manhattan Project workers should be awarded \$150,000 compensation for damages caused by injuries during work. The standard used by the Justice Department is more likely than not 50% at the 99th percentile. For Ms. Woods situation, that would be 98.7%, that is, a near certainty. In my opinion, it is a near certainty that radiation from the Harvey Yard caused Ms. Woods leukemia.

Tables and Figures

Year	Red Marrow (Rem)
------	---------------------

1957	4.02
1958	4.02
1959	4.02
1960	4.02
1961	6.62
1962	6.62
1963	6.62
1964	6.62
1965	6.62
1966	11.50
1967	11.50
1968	11.50
1969	7.87
1970	7.86
1971	29.89
1972	29.89
1973	29.83
1974	29.83
1975	29.78
1976	33.57
1977	33.56
1978	33.22
1979	0.00
1980	32.98
1981	32.68
1982	32.53
1983	0.00
1984	0.00
1985	0.00
1986	0.00
1987	0.00
1988	0.00
1989	0.00
1990	0.00
1991	0.00
1992	27.06

Table 1. Red Marrow Dose to M Woods

Figure 1. Location of 1219 Paillet Ave, Harvey, LA

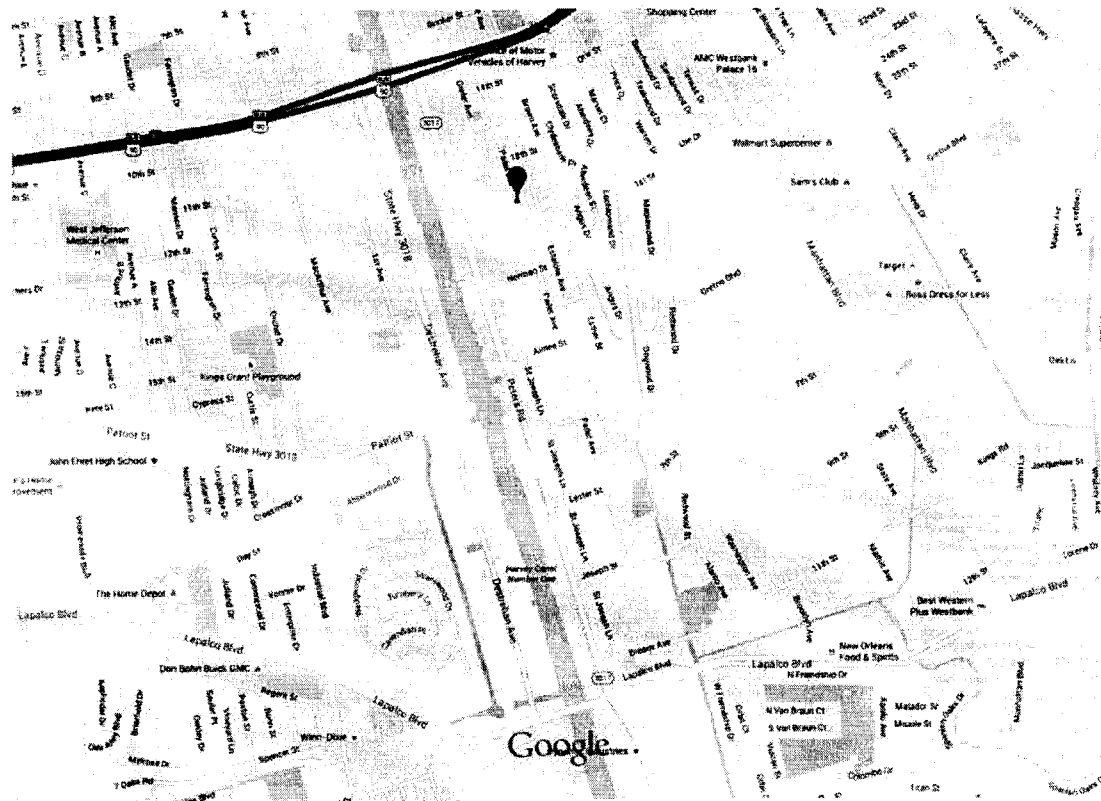


Fig.2

**Deposition Modeling
1970 and After
(values in grams per square meter)**

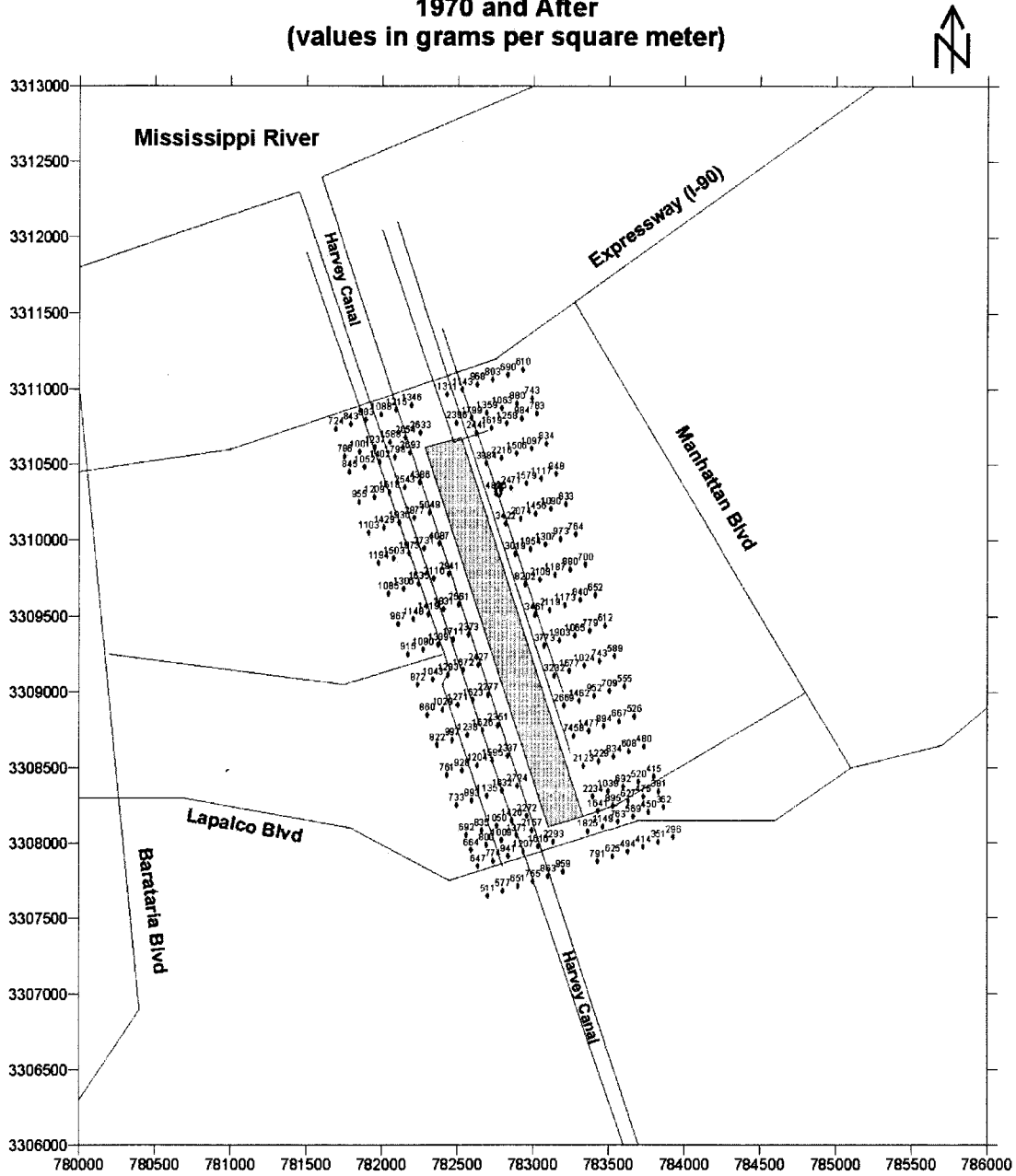
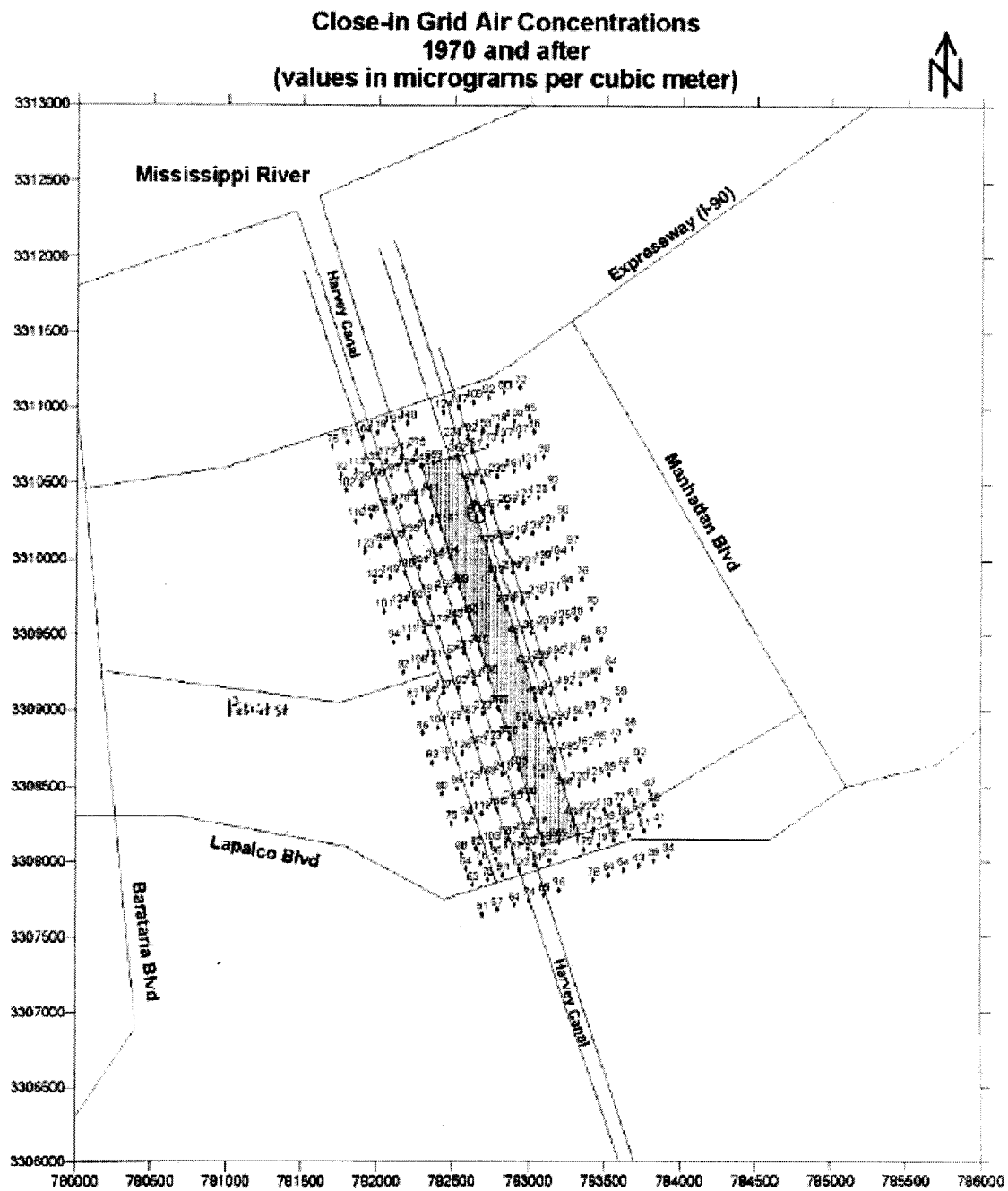


Fig 3.





Interactive RadioEpidemiological Program Summary Report

IREP 5.6.1 using Analytica/ADE 4.5 64-bit

Report Date: 09/29/2015 01:08:33 PM

Information Used In Assigned Share (Probability of Causation) Calculation

Gender	Female	Race	N/A
Birth Year	1957	Year of Diagnosis	1993
Cancer Model	Acute Myeloid Leukemia (205.0)	Smoking history	N/A

IREP Assumptions and Settings

User Defined Uncertainty Distribution	Lognormal (1,1)
Number of Iterations	2000
Random Number Seed	99

General Exposure Information

Exposure #	Exposure Year	Organ Dose (cSv)	Exposure Rate	Radiation Type
1	1963	Normal (6.62, 0)	chronic	alpha
2	1964	Normal (6.62, 0)	chronic	alpha
3	1965	Normal (6.62, 0)	chronic	alpha
4	1966	Normal (11.5, 0)	chronic	alpha
5	1967	Normal (11.5, 0)	chronic	alpha
6	1968	Normal (11.5, 0)	chronic	alpha
7	1969	Normal (7.87, 0)	chronic	alpha
8	1970	Normal (7.86, 0)	chronic	alpha
9	1971	Normal (29.9, 0)	chronic	alpha
10	1972	Normal (29.9, 0)	chronic	alpha
11	1973	Normal (29.8, 0)	chronic	alpha
12	1974	Normal (29.8, 0)	chronic	alpha
13	1975	Normal (29.8, 0)	chronic	alpha
14	1976	Normal (33.6, 0)	chronic	alpha
15	1977	Normal (33.6, 0)	chronic	alpha
16	1978	Normal (33.2, 0)	chronic	alpha
17	1979	Normal (0, 0)	chronic	alpha
18	1980	Normal (33, 0)	chronic	alpha
19	1981	Normal (32.7, 0)	chronic	alpha
20	1982	Normal (32.5, 0)	chronic	alpha
21	1992	Normal (27.1, 0)	chronic	alpha

Assigned Share (Probability of Causation) Results

Percentile	1st	5th	50th	95th	99th
Assigned Share	23.216 %	29.512 %	68.782 %	94.479 %	97.739 %

References

Biggs, Gale, "Air Dispersion Impact Assessment of the Harvey Term Site," W Gale Biggs Associates, P.O. Box 3344, Boulder, CO 80307, January 2005

Chan-Hyeong K, Rensselaer Polytechnic Institute, available at http://www.rpi.edu/~kimc/RSO_training/RSO_training_1.pdf, accessed June, 200

Code of Federal Regulations (CFR), 10(20):1201(a)(2)(ii)

ICRP 1994, ICRP Publication 66, Human Respiratory Tract Model for Radiological Protection, Ann. ICRP 24 (1-3), 1994, Table 16A

ICRP, 2011, International Commission on Radiological Protection, ICRP Database

National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation*, Committee of the Biological Effects of Ionizing Radiation (BEIR-V), National Academy Press, 175 (1990).

NORM Study Team, Chevron USA, Inc. 1990. Final Report: Naturally Occurring Radioactive Materials in Production Operations

Reed, G, B Holland, and A McArthur. 1991. Evaluating the Real Risks of Radioactive Scale in Oil and Gas Production, in Proceedings of the First International Conference on Health, Safety and the Environment, held in The Hague, Netherlands, Society of Petroleum Engineers, Ponville, TX.

US-EPA. 1987. Letter from Charles R Porter to Eddie S Fuentz (MS DOH), with attached report on radiological survey of the Case Property

U.S. EPA 1993, "External Exposure to Radionuclides in Air, Water and Soil, EPA 402-R-93-081.

Virtual Naval Hospital, Radiation Dispersal Device and Industrial Contamination Situations, available at <http://www.vnh.org/MedManRadCasu/2.html>, accessed in June 2002

Wilson, AJ and LM Scott. 1992. Characterization of Radioactive Petroleum Piping Scale with Evaluation of Subsequent Land Contamination. Health Physics. Volume 63, Issue 6, pp: 681-668

Appendix A. Resume

Dr. MARVIN RESNIKOFF is an international consultant on radioactive waste issues. A nuclear physicist and a graduate of the University of Michigan, Dr. Resnikoff has worked on radioactive issues since his first project at West Valley, New York in 1974. Throughout his career, he has assisted public interest groups and state and local governments across the US in order to identify and create solutions for radioactive waste storage and transportation issues. His recent research focus has been on the risk of transporting and storing radioactive waste and the health impact of radioactive waste from oil and uranium production. Dr. Resnikoff has also co-authored four books on radioactive issues, including *Deadly Defense* and *Danger Below*, both regarding contamination at DOE facilities. In June 2000, he was appointed by DOE secretary Bill Richardson to a Blue Ribbon Panel on Alternatives to Incineration. In August 2010, he was an invited panelist to President Obama's Blue Ribbon Commission on Nuclear Safety. In October 2011, he was an invited panelist at the annual conference of the Water Environment Federation on the subject of radioactivity in Marcellus shale wastes. In November 2013, he was an invited panelist before the Nuclear Waste Technical Review Board on the subject of the implication of high burnup nuclear fuel on decommissioning and transportation.

Since 1992, he has researched NORM issues, continuing to serve as an expert witness in personal injury cases in Mississippi, Louisiana and Texas on behalf of workers injured while cleaning radium-contaminated oil pipes. In 2009, he served as an expert witness for a Texas rancher whose land was contaminated by natural gas operations. He also served as an expert witness for public interest groups concerned with Marcellus shale rock cuttings going to the Chemung County, New York solid waste landfill. In 2012, he prepared a report for public interest groups on the NORM situation in Ohio. He is presently preparing a report on the impact of natural gas exploration and production in Pennsylvania.

He has conducted studies on the remediation and closure of the leaking Maxey Flats, Kentucky radioactive landfill for Maxey Flats Concerned Citizens, Inc. and of the leaking uranium basin on the NMI/Starmet site in Concord, Massachusetts under grants from the Environmental Protection Agency. He co-authored a study on the cost of remediating the former West Valley, New York reprocessing plant site. He also conducted studies of the Wayne and Maywood, New Jersey thorium Superfund sites and proposed low-level radioactive waste facilities at Martinsville (Illinois), Boyd County (Nebraska), Wake County (North Carolina), Ward Valley (California) and Hudspeth and Andrews Counties (Texas). He investigated phosphogypsum plants in Florida, Texas and Alberta, Canada, and served as an expert witness in a personal injury case involving a Texas phosphogypsum worker. He also served as an expert witness for CRPE, a public interest group, regarding the proposed expansion of the Buttonwillow, California NORM landfill. He was an expert witness for Earthjustice re. the licensing of an irradiation facility near the Honolulu airport in Hawaii. He is serving as an expert witness for Niagara County, New York, in a licensing hearing re. an application by CWM to expand its hazardous waste landfill.



RADIOACTIVE WASTE MANAGEMENT ASSOCIATES

Marvin Resnikoff, Ph.D. Curriculum Vitae

EDUCATION:

Ph.D., Physics
M.S., Physics
B.A., Physics/Math

1965, University of Michigan
1962, University of Michigan
1959, University of Michigan

SUMMARY OF PROFESSIONAL EXPERIENCE:

Marvin Resnikoff is Senior Associate at Radioactive Waste Management Associates and is an international consultant on radioactive waste management issues. He is Principal Manager at Associates and is Project Director for dose reconstruction and risk assessment studies of radioactive waste facilities and transportation of radioactive materials. Dr. Resnikoff has concentrated exclusively on radioactive waste issues since 1974. He has authored or co-authored four books on radioactive waste issues.

He has conducted dose reconstruction studies of oil pipe cleaners in Mississippi and Louisiana, residents of Canon City, Colorado near a former uranium mill, residents of West Chicago, Illinois near a former thorium processing plant, and residents and former workers at a thorium processing facility in Maywood, New Jersey. He has also served as an expert witness for plaintiffs in Karnes County, Texas, Milan, New Mexico and Uravan, Colorado, who were exposed to radioactivity from uranium mining and milling activities. He is continuing to work on personal injury cases involving former workers and residents at the ITCO and other oil pipe cleaning yards in Louisiana and Texas. He also evaluated radiation exposures and risks in worker compensation cases involving former workers at Maywood Chemical Works thorium processing plant. He also served as an expert witness in a case involving the Port St. Lucie reactors and brain cancer developed by two children and in a case involving clean-up of an abandoned radioactive materials processing facility in Webster, Texas. He is presently working on several land contamination cases in Louisiana, Texas and New York. In June 2000, he was appointed to a Blue Ribbon Panel on Alternatives to Incineration by DOE Secretary Bill Richardson.

In addition to dose reconstruction and land contamination cases, Dr. Resnikoff also works on the risk of transporting radioactive material. Under a contract with the State of Utah, Dr. Resnikoff was a technical consultant to DEQ on the proposed dry cask storage facility for high-level waste at Skull Valley, Utah. He assisted the State on licensing proceedings before the Nuclear Regulatory Commission. He has also prepared studies on transportation risks and consequences for the State of Nevada and the Nevada counties: Clark, White Pine, Lander and Churchill. In addition, at hearings before state commissions and in federal court, he investigated proposed dry storage facilities at the Point Beach (WI), Prairie Island (MN), Palisades (MI), Maine Yankee, Connecticut Yankee and Vermont Yankee reactors. He is presently working for the State of Nevada on Yucca Mountain repository issues before the Nuclear Regulatory Commission (NRC). He is also serving as an expert witness for Earthjustice on a proposed NRC license for a food irradiator at the Honolulu, Hawaii airport.

He has conducted studies on the remediation and closure of the leaking Maxey Flats, Kentucky radioactive landfill for Maxey Flats Concerned Citizens, Inc. and of the leaking uranium basin on the NMI/Starmet site in Concord, Massachusetts under grants from the Environmental Protection Agency. He co-authored a study on the cost of remediating the former West Valley, New York reprocessing plant site. He also conducted studies of the Wayne and Maywood, New Jersey thorium Superfund sites and proposed low-level radioactive waste facilities at Martinsville (Illinois), Boyd County (Nebraska), Wake County (North Carolina), Ward Valley (California) and Hudspeth County (Texas). He investigated phosphogypsum plants in Florida, Texas and Alberta, Canada, and served as an expert witness in a personal injury case involving a Texas phosphogypsum worker. He also served as an expert witness for CRPE, a public interest groups, regarding the proposed expansion of the Buttonwillow, California NORM landfill. He is presently working for Earthjustice re. the licensing of an irradiation facility near the Honolulu airport in Hawaii.

In Canada, he conducted studies on behalf of the Coalition of Environmental Groups and Northwatch for hearings before the Ontario Environmental Assessment Board on issues involving radioactive waste in the nuclear fuel cycle and Elliot Lake tailings and the Interchurch Uranium Coalition in Environmental Impact Statement hearings before a Federal panel regarding the environmental impact of uranium mining in Northern Saskatchewan. He also worked on behalf of the Morningside Heights Consortium regarding radium-contaminated soil in Malvern and on behalf of Northwatch regarding decommissioning the Elliot Lake tailings area before a FEARO panel. He conducted a study for Concerned Citizens of Manitoba regarding transportation of irradiated fuel to a Canadian high-level waste repository. He is presently working for Greenpeace reviewing the environmental assessment for a proposed intermediate level waste repository under Lake Huron, and for the Provincial Womens Council of Ontario on radioactive waste management costs in a proceeding before the Ontario Energy Board.

In February 1976, assisted by four engineering students at State University of New York at Buffalo, Dr. Resnikoff authored a paper that, according to *Science*, changed the direction of power reactor decommissioning in the United States. His paper showed that power reactors could not be entombed for long enough periods to allow the radioactivity to decay to safe enough levels for unrestricted release. The presence of long-lived radionuclides meant that large volumes of decommissioning waste would still have to go to low-level or high-level waste disposal facilities. He assisted public interest groups on the decommissioning of the Yankee-Rowe, Diablo Canyon, Big Rock Point and Haddam Neck reactors.

He was formerly Research Director of the Radioactive Waste Campaign, a public interest organization conducting research and public education on the radioactive waste issue. His duties with the Campaign included directing the research program on low-level commercial and military waste and irradiated nuclear fuel transportation, writing articles, fact sheets and reports, formulating policy and networking with numerous environmental and public interest organizations and the media. He is author of the Campaign's book on "low-level" waste, *Living Without Landfills*, and co-author of the Campaign's book, *Deadly Defense, A Citizen Guide to Military Landfills*.

Between 1981 and 1983, Dr. Resnikoff was a Project Director at the Council on Economic Priorities, a New York-based non-profit research organization, where he authored the 390-page study, *The Next Nuclear Gamble, Transportation and Storage of Nuclear Waste*. The CEP study details the hazard of transporting irradiated nuclear fuel and outlines safer options.

Dr. Resnikoff is an international expert in nuclear waste management, and has testified often before State Legislatures and the U.S. Congress. He has extensively investigated the safety of the West Valley, New York and Barnwell, South Carolina nuclear fuel reprocessing facilities. His paper on reprocessing economics (Environment, July/August, 1975) was the first to show the marginal economics of recycling plutonium. He completed a more detailed study on the same subject for the Environmental Protection Agency, "Cost/Benefits of U/Pu Recycle," in 1983. His paper on decommissioning nuclear reactors (Environment, December, 1976) was the first to show that reactors would remain radioactive for several hundred thousand years. In March 2004, Dr. Resnikoff was project director and co-author of a study of groundwater contamination at DOE facilities, *Danger Lurks Below*.

Dr. Resnikoff has prepared reports on incineration of radioactive materials, transportation of irradiated fuel and plutonium, reprocessing, and management of low-level radioactive waste. He has served as an expert witness in state and federal court cases and agency proceedings. He has served as a consultant to the State of Kansas on low-level waste management, to the Town of Wayne, New Jersey, in reviewing the cleanup of a local thorium waste dump, to WARD on disposal of radium wastes in Vernon, New Jersey, to the Southwest Research and Information Center and New Mexico Attorney General on shipments of plutonium-contaminated waste to the WIPP facility in New Mexico and the State of Utah on nuclear fuel transport. He has served as a consultant to the New York Attorney General on air shipments of plutonium through New York's Kennedy Airport, and transport of irradiated fuel through New York City, and to the Illinois Attorney General on the expansion of the spent fuel pools at the Morris Operation and the Zion reactor, to the Idaho Attorney General on the transportation of irradiated submarine fuel to the INEL facility in Idaho and to the Alaska Attorney General on shipments of plutonium through Alaska. He was an invited speaker at the 1976 Canadian meeting of the American Nuclear Society to discuss the risk of transporting plutonium by air. As part of an international team of experts for the State of Lower Saxony, the Gorleben International Review, he reviewed the plans of the nuclear industry to locate a reprocessing and waste disposal operation at Gorleben, West Germany. He presented evidence at the Sizewell B Inquiry on behalf of the Town and Country Planning Association (England) on transporting nuclear fuel through London. In July and August 1989, he was an invited guest of Japanese public interest groups, Fishermen's Cooperatives and the Japanese Congress Against A- and H- Bombs (Gensuikin).

Between 1974 and 1981, he was a lecturer at Rachel Carson College, an undergraduate environmental studies division of the State University of New York at Buffalo, where he taught energy and environmental courses. The years 1975-1977 he also worked for the New York Public Interest Group (NYPIRG).

In 1973, Dr. Resnikoff was a Fulbright lecturer in particle physics at the Universidad de Chile in Santiago, Chile. From 1967 to 1973, he was an Assistant Professor of Physics at the State University of New York at Buffalo. He has written numerous papers in particle physics, under grants from the National Science Foundation. He is a 1965 graduate of the University of Michigan with a Doctor of Philosophy in Theoretical Physics, specializing in group theory and particle physics. Dr. Resnikoff is a member of the American Public Health Association and the Health Physics Society.

PROFESSIONAL EXPERIENCE:

April 1989 - present **Senior Associate**, Radioactive Waste Management Associates, management of consulting firm focused on radioactive waste issues, evaluation of nuclear transportation and military and commercial radioactive waste disposal facilities.

1978 - 1981; 1983 - April 1989 **Research Director**, Radioactive Waste Campaign, directed research program for Campaign, including research for all fact sheets and the two books, *Living Without Landfills*, and *Deadly Defense*. The fact sheets dealt with low-level radioactive waste landfills, incineration of radioactive waste, transportation of high-level waste and decommissioning of nuclear reactors. Responsible for fund-raising, budget preparation and project management.

1981 - 1983 **Project Director**, Council on Economic Priorities, directed project which produced the report *The Next Nuclear Gamble*, on transportation and storage of high-level waste.

1974 - 1981 **Instructor**, Rachel Carson College, State University of New York at Buffalo, taught classes on energy and the environment, and conducted research into the economics of recycling of plutonium from irradiated fuel under a grant from the Environmental Protection Agency.

1975 - 1976 **Project Coordinator**, SUNY at Buffalo, New York Public Interest Research Group, assisted students on research projects, including project on waste from decommissioning nuclear reactor.

1973 **Fulbright Fellowship** at the Universidad de Chile, conducting research in elementary particle physics.

1967 - 1972 **Assistant Professor of Physics**, SUNY at Buffalo, conducted research in elementary particle physics and taught a range of graduate and undergraduate physics courses.

1965 - 1967 **Research Associate**, Department of Physics, University of Maryland, conducted research into elementary particle physics.

PROFESSIONAL ORGANIZATIONS:

Health Physics Society
Water Environment Federation

SPECIAL SPEAKING ENGAGEMENTS:

- 1967 Invited Speaker, w/ O.W. Greenberg, Meeting of the American Physical Society, Washington, D.C., "Symmetric Quark Model of Baryon Resonances," Conf-670414—6.
- 1976 Invited Speaker, Meeting of the American Nuclear Society, Toronto, Canada, "Comparison of risk assessments of Pu released during transport."
- 1976 Statement before the Subcommittee on Energy and the Environment of the Interior Committee, House of Representatives, on recycling of plutonium.
- 1977 Statement before the Subcommittee on Government Operations, House of Representatives, on Nuclear Power Costs
- 1979 Chaired panel w/Dr. Karl Morgan and Dr. Alice Stewart, Gorleben International Review, on the health effects of radiation, Hanover, Germany.
- 2000 Invited day-long seminar presentation to the California Department of Health on the health effects of radiation
- 2002 Testimony before the Committee on Transportation & Infrastructure, United States House of Representatives, on transportation of nuclear materials.
- 2003 Presentation before the National Academy of Sciences Study Committee on Transportation of Radioactive Waste, Las Vegas, NV, "Baltimore Tunnel Fire: Implications for SNF Transportation Safety."
- 2006 Biglin, K. and Resnikoff, M, Emergency Response to a Nuclear Waste Shipment Accident, Inyo County, June 15, 2006, paper presented at ESRI Annual Conference, August 2006.
- 2008 Invited Speaker, Meeting of the American Nuclear Society, Anaheim, CA, "State of Nevada Recommendations for Yucca Mountain Transportation Safety and Security."
- 2008 Presentation at Waste Management 2008, Phoenix, AZ, "Fugitive Dust Emissions from Uranium Haul Roads."
- 2008 Presentation at Waste Management 2008, Phoenix, AZ, "State of Nevada Perspective on the US DOE Yucca Mountain Transportation Program."

Books and Articles

Resnikoff, M, "Expensive Enrichment," *Environment*, July/August 1975, pp. 28–35.

Harwood, S *et al*, "The Cost of Turning It Off," *Environment*, December 1976, pp.17-26.

M. Resnikoff, "Environmental Perspective." Chapter 7 in "The Politics of Nuclear Waste," edited by William Colglazier, Pergamon Press, 1982

M. Resnikoff, *et al*, "The Next Nuclear Gamble, Transportation and Storage of Nuclear Waste," Council on Economic Priorities, 1983.

M. Resnikoff, "Shipping Flasks in Severe Rail Accidents," Chapter 18 in "The Urban Transportation of Irradiated Fuel," edited by John Surrey, Macmillan Press, London, 1984.

M. Resnikoff, "Living Without Landfills," Radioactive Waste Campaign, 1988.

M. Resnikoff, *et al*, "Deadly Defense, A Citizen Guide to Military Landfills," Radioactive Waste Campaign, 1989.

M. Marvin Resnikoff, "The Generation Time Bomb: Radioactive and Chemical Wastes." Chapter in "Hidden Dangers: Environmental Consequences of Preparing for War," edited by Anne Ehrlich and John Birks, Sierra Club Books, San Francisco, 1990.

I. Fairlie and M. Resnikoff, "No Dose Too Low," *The Bulletin of Atomic Scientists*, Nov/Dec 1997.

M. Resnikoff, "Danger Lurks Below," Alliance for Nuclear Accountability, 2004.

M Resnikoff, "Radon in Natural Gas from Marcellus Shale," *Ethics in Biology, Engineering & Medicine*, Vol. 2, Issue 4, 2011, pp. 317- 331.