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Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for Maywood, New Jersey

U.S. Department of Energy

0489-0613.1

CONCERNED CITIZENS of MAYWOOD

119345

FOR IMMEDIATE RELEASE

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AUG 11 8 39 AM '94

August 4th, 1994.

Ms. Susan Cange, Site Manager,
U.S. Dept. of Energy,
P.O. Box 2001,
Oak Ridge, Tennessee. 37831-8723.

Ms. Cange:
Enclosed is copy of Radioactive Waste Management Associates' (RWMA) comments (critique) July 27, 1994, on the U.S. Department of Energy's baseline risk assessment for the Maywood site, Maywood, N.J. (April 1993).

This critique clearly challenges the assumptions and the procedures of the DOE leading to their erroneous conclusions. The future land use assumptions are flawed and we suggest you solicit DOE's Mr. J. Baublitz's testimony, January 27, 1986 for exposure on "commercial properties in use" Phase I at the Maywood site.

There is no question that the Maywood site must be permanently cleaned up to the EPA acknowledged health based 5 pci/g standard for unrestricted use without controls or 5-year review for residual contamination.

CERCLA calls for permanent clean up and compliance with state regulations. DOE should cease their delays and comply or a full federal investigation should commence immediately.

By copy of this letter, our elected federal officials are being solicited to provide the appropriate directive to DOE, if DOE continues to stonewall.

We expect that this critique by RWMA will be properly included in the administrative records of DOE and EPA and would like confirmation that this has been done.

Michael J. Nolan
Environmental Chairman

cc: Senator Lautenberg
Congressman Torricelli
Richard Gimella, Assistant Commissioner NJDEP
Maywood Mayor & Council
Hazel O'Leary, DOE Secretary
Carol Browner, EPA Administrator
Pat Schuber, Bergen County Executive
Dr. M. Resnikoff.

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RADIOACTIVE WASTE MANAGEMENT ASSOCIATES

Comments on the Department of Energy's Baseline Risk Assessment for the Maywood Site Maywood, New Jersey April 1993

by

Dr. Marvin Resnikoff, Dr. Richard Leigh and Phyllis Fuchsman
Radioactive Waste Management Associates
July 27, 1994

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This review of the Baseline Risk Assessment for the Maywood Site[1] is prepared on behalf of Concerned Citizens of Maywood by Radioactive Waste Management Associates under a TAG grant from the Environmental Protection Agency (EPA). In preparing this critique, we have reviewed a large number of references which are listed at the end of this report.

The Maywood site consists of a large number of properties, which DOE has attempted to characterize so as to detail the risk and determine the extent of contamination. In order to take a larger perspective, we will attempt to synthesize and analyze the results of the Remedial Investigation,[2] Baseline Risk Assessment and other documents and come to broader brush conclusions. In this report, we have concentrated on radioactive contamination, although chemical contamination at the site is also extensive.

DOE clearly presents the purpose of the Baseline Risk Assessment (BRA). It is ". . . to evaluate the risk to human health and the environment from the radioactive and chemical contaminants in the absence of remedial action." The report "does not assume future control [of the site] by DOE," and "current institutional controls are not expected to remain in place."[3] In other words, the report is an evaluation of the public health costs of the "no-action alternative," for which DOE is legally mandated to assume that in the near future it simply walks away from the site.

The BRA presents a brief history of the Maywood site, on which we have expanded with information from various sources. We have also investigated the extent to which DOE has fulfilled the report's stated purpose. In our opinion, the Department has seriously underestimated current and future health risks, by failing to account for all exposure pathways, incorrectly calculating background contamination, and incorrectly converting estimated radiation doses to cancer risks. DOE has also failed to assume the end of institutional controls in its assumptions of future land use and movement of contaminants. The movement of contaminants in surface and ground water is of particular

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[1] US Department of Energy, *Baseline Risk Assessment for the Maywood Site, Maywood, New Jersey*, DOE/OR/21950-003, April 1993.
[2] US Department of Energy, *Remedial Investigation Report for the Maywood Site, Maywood, New Jersey*, DOE/OR/21949-337, December 1992.
[3] BRA, p. ES-1.

concern. In addition, we have commented on the Department's selection of chemical "contaminants of concern."

Site Background

All parties agree that the original source of radioactive contamination in Maywood and adjacent boroughs was the Maywood Chemical Works. For 40 years, between 1916 and 1956, the Maywood Chemical Works imported large volumes of monazite sands, from which it extracted rare earths and thorium. The wastes from the extraction procedures - sludges, liquids and tailings - contained large quantities of unextracted thorium-232, as well as uranium-238, another component of the original monazite sands.

From the more recent characterization reports, it is difficult to understand the full hazard posed by these waste materials. Atomic Energy Commission (AEC) Inspection Reports in the late 1950's and early '60's provide an estimate of the radioactive concentrations. Radiation readings atop the on-site thorium sulfate pile were 5.5 millirems per hour (mr/h),[4] which corresponds to thorium-232 concentrations close to 3000 pCi/g. A May 15, 1961 AEC Inspection Report describes radioactive concentrations up to 6,400 pCi/g thorium-232. Because of the long half-life of thorium-232, these waste materials will remain radioactive essentially forever.

During the early years of operation, the extraction residues were pumped to unlined diked areas in a low-lying western portion of the original site (now the Ballod property) and other diked areas on the original site. Additionally, wastes were dumped into nearby wetlands:

> "The manufacture and sale of gas mantles, containing thorium nitrate, was instituted at Maywood Chemical Works some time in 1916. At this time the company occupied a relatively small area adjoining a large swampy area draining into and forming part of the natural water shed of that area. As the company expanded and operations continued, much of the swampy area was filled in by process residues containing approximately 1 - 2% of thorium. A respectable area of Maywood Chemical Works is now standing upon this filled-in ground. Historically, but without documentation, additional large areas, which are now

[4] Letter from W. Karp, Head Source Dept, AEC to J Huber, Maywood Chemical Works, June 22, 1962.

outside of the company property, were used as dumping areas for process wastes. U.S. Route 17 was built through this area, and fairly extensive areas on the other side of Route 17 were also used as dumps for process materials by Maywood Chemical Works."[5]

Route 17 was built in 1932 on top of some of the thorium tailings, cutting through a large storage area located near the intersection of the route and the New York, Susquehanna and Western railroad tracks, near the north corner of the present Maywood Interim Storage Site (MISS). After this point, tailings were trucked to the Ballod property and later were pumped to a diked area on the property of Maywood Chemical Works to the east of Route 17. A large slurry mound, two football fields in area and 20' high, was located in the north corner of the present MISS.

Radioactive contamination continued after the close of thorium extraction operations at Maywood Chemical. To understand the magnitude of the problem and the level of the company's awareness, we quote from a 1963 AEC Inspection Report:

"The amount of thorium leaving the plant site by mechanical, airborne or solvent action is not known. There is no doubt that some thorium has been transported by leaching action of rain and surface water to the Bergen County water shed.

"The inspections conducted on 5/24/57 and 5/15/61 revealed that the licensee did not possess any radiological survey instruments . . . The licensee had obtained a Civilian Defense GM survey meter, range 0 - 50 mr/hr. Alrutz stated he intended to use this instrument during the proposed clean-up program at Maywood.

"Mr. James Alrutz, graduate chemist and Production Manager at the Maywood facility, has the collateral duty of Radiation Safety Officer. Alrutz has had no special training in the field of radiological safety. He has learned to use a survey meter and to a limited degree has become familiar with the provisions of Parts 20 and 40 . . . Alrutz stated that he has complete authority in the area of radiological safety.

"It is noted that personnel monitoring has never been utilized, even during the period of active processing of monazite sands."[6]

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[5] AEC Inspection Report, August 30 and September 4, 1963.
[6] AEC Inspection Report, August 30 and September 4, 1963.

Although a small amount of thorium waste was sold off, much, including the huge slurry pile, was ultimately moved to on-site, underground storage. Beginning November 1966 through August 1967, thorium wastes from two locations on Stepan Company property east of Rte. 17 were transferred to unlined burial pits on the present Stepan Company site and covered with topsoil. A total of 8,360 and 2,053 cubic yards of radioactive tailings were transferred to Burial Pits 1 and 2 in 1966 and 1967, respectively. In June 1968, 8,600 cubic yards of waste were moved from the South Dike area of the Ballod property to Burial Pit 3[7]. The 1968 storage/burial operation was apparently done without the knowledge or permission of the Atomic Energy Commission. Stepan Company management was fined $20,000 for deliberately concealing this information from federal inspectors.

The present arrangement for managing the thorium waste materials is described as "storage" by the Nuclear Regulatory Commission (NRC). In NRC terms, "storage" is considered temporary, whereas "disposal" is intended to be permanent. The Stepan Company, which bought Maywood Chemical Works, continues to hold a "possession only" license, under which it was allowed to decontaminate and store the wastes. In February 1971, the Stepan Co. attempted to allow its AEC license to lapse, saying it no longer "possessed" radioactive materials, but this attempt to make the thorium waste materials "disappear" was foiled by the AEC. It is extremely important to emphasize that these wastes have never been disposed of.

Similar to the release of the Grace & Co. license at the Wayne site, the AEC allowed contaminated properties to be released for unrestricted use without a risk assessment and without a careful analysis of future radiation doses to the general public. To this day, the NRC does not require a risk assessment when a license is terminated. By contrast, the EPA does require risk assessments before the release of Superfund sites. Several former AEC licensees are now engaged in defense against damage suits as a result of lax waste management practices and regulatory procedures.

Among the seriously contaminated areas now outside the Stepan Company is the Ballod property or former South Dike area. The history of the Ballod site holds important lessons for the future use of contaminated properties and the risk assessment for the Maywood area. Following removal of contaminants from this property, direct gamma readings averaged 0.05 to 0.1 mr/hr, with spots up to 0.3 mr/hr. While this was acceptable to AEC inspectors, for full-time occupancy, the yearly whole body dose due to

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[7] AEC Inspection Report, Oct 18 and Nov 2, 1967.

direct gamma radiation alone (and other pathways should also be included), would be up to 900 mr/yr, considerably above the present limit of 100 mr/yr, or the limit at the time, 500 mr/yr. Following unrestricted release of the property, the former South Dike area was sold to a developer, Barisi, who had materials hauled off the site so he could build.[8] The location of these disposed of materials was not stated, but it is likely this movement radioactively contaminated yet another location. In 1977, Barisi hired Kramer Associates, contractors from Ft Lee, to remove additional material from a 10 acre area to a depth of 6 feet. This created, we assume, yet another contaminated area which has not been located. Fill and rubble replaced this exhumed material. The land was never developed and was eventually sold to Ballod & Associates, hence the name. The zoning was changed from industrial to residential and an old age home was built on a portion of the property. There is no reason to believe that this history will not repeat itself at other contaminated properties in Maywood, since the trend is away from industrial and towards residential use. Zoning for the contaminated Scanel property has been changed from light industrial to mid-rise residential; the zoning for the MISS has been changed from light industrial to commercial high rise.

Another seriously contaminated area is designated by DOE as "Unit 7H." This square, 10-acre area lies adjacent to the Sears and Desaussure buildings and is covered by common reed (*Phragmites*), a species characteristic of polluted or disturbed marshlands. A small runoff drainage ditch originates in this area. Unit 7H presently has much higher direct gamma radioactivity levels than the surrounding asphalt-paved parking lots. Though one report is equivocal that residues from the processing operation may have been used as landfill in this area,[9] the AEC Inspection Report quoted previously clearly points to the unit as one of the "large areas . . . now outside of the company property . . . used as dumping areas for process wastes." These earlier landfilling practices on the part of Maywood Chemical Works may also account for the present contamination of properties along the former Lodi Brook.

The means by which other properties associated with the Maywood site became contaminated is less clear. For instance, were properties south of the Stepan Company along Lodi Brook contaminated by surface waters carrying radioactive thorium, uranium and decay products? Were some properties contaminated when radioactive fill, including contaminated mulch, was removed from the Maywood Chemical Works? If fill was

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[8] NJ DEP, Site Inspection Report, Thomas Brady, Oct 7, 1980.

[9] Ebasco Services Inc, "Final Report for the Maywood Chemical Company Site: Sears and Vicinity Properties, Maywood, New Jersey," prepared for the US EPA, February 1987.

removed, was this done with the permission or knowledge of the management? Was the contamination of the Lodi water supply caused by underground migration from the Maywood Chemical Works? The answers to these questions directly relate to future risk, both by providing clues as to how radioactive materials are now migrating in the area and by demonstrating ways by which people could continue to move the waste in the future. These questions have not been resolved by the Maywood BRA. We discuss the special situation of the Lodi municipal wells in the "Water" section below.

In 1984, responsibility for clean-up was assigned to the DOE by the U.S. Congress. Since the Maywood site was designated a Superfund site by the EPA a year earlier, the EPA also has jurisdiction over the cleanup. The DOE is in the process of preparing a Feasibility Study which will lay out the remediation options for the Maywood site and associated contaminated properties.

Present Risk Estimates

DOE has estimated current radiation doses and associated fatal cancer risks for the various "property units" of the Maywood site. For the majority of residential properties, DOE estimates an average dose of 51 mr/year and a maximum dose of 246 mr/year. The associated cancer risks are calculated to be $3x10^{-4}$ for the average dose and $4x10^{-3}$ for the maximum dose. Average dose estimates for the most dangerously contaminated commercial/government properties range from 114 to 171 mr/year, with maximum estimates of from 142 to 281 mr/year. These are translated to cancer risks ranging from $5x10^{-4}$ to $7x10^{-4}$ for average doses and $2x10^{-3}$ to $4x10^{-3}$ for the maximum doses. Though not clearly stated by the Maywood BRA, cancer risk is only one risk of radiation; other risks are genetic effects, including birth defects, non-fatal cancers, and radiation-related illnesses.

These doses as estimated by DOE exceed the regulatory limits of 100 mr/year for public exposure due to operating nuclear facilities and 25 mr/year for low-level waste disposal facilities. However, the actual situation is in fact even more serious. DOE has underestimated exposures by failing to fully measure radon and thoron levels, as well as by overestimating background radiation levels. Furthermore, DOE has underestimated the cancer risk associated with given doses by employing an unwarranted "dose reduction

effectiveness factor" and by failing to adequately distinguish between risks to children and adults.

Radon-222 and Lead-212 Inhalation Exposure

When contaminated soils are exposed to air, radon-222 and radon-220 (thoron) emanate as inert radioactive gases. Radon-222 and thoron are decay products in the uranium-238 and thorium-232 decay chains, respectively. Because of its longer half-life of 3.8 days, radon-222 is more likely to be detected in air than thoron, which has a 55.6 second half-life. Radon-222 was detected in the air immediately adjacent to the MISS. One would expect radon-222 to be detected in other areas as well, such as the highly contaminated, marshy "Unit 7H," but DOE did not test for it in most probable locations. A new report, giving radon measurements for 19 commercial properties, will be released soon. The report will also add to data on direct gamma radiation at these properties.

More serious than the inadequacy of radon-222 data is the fact that DOE did not test for thoron at all, although they claim to have done so in some areas. Thoron ultimately decays to lead-212, with a half-life of 10.64 hours. Thus, it is not thoron, but lead-212 particulates that would be detected. DOE failed to employ the high volume air particulate sampling methods that would be required to detect lead-212 particulates. These particulates are the major source of inhalation exposures in the thorium-232 decay chain. At all thorium waste locations we have studied, the major risk is due to direct gamma, followed by the risk due to inhalation of lead-212. Characterization of the Kerr-McKee site in West Chicago, Illinois by the EPA has identified lead-212 as the major risk[10]. We are of the opinion the DOE and its contractors have made a major error in not measuring for lead-212 particulates and accounting for this risk.

Background Concentrations in Soil

Another error in estimating radiation doses lies in the determination of "background" radiological contamination in soil. The DOE is correct in subtracting background concentrations from the measured concentrations of each radiological contaminant in soils, since the Maywood Chemical Works' past thorium processing activities are not responsible for the fraction of cancers and other ailments that can be attributed to naturally occurring background radiation. However, the DOE makes a

[10] Environmental Protection Agency, *Remedial Investigation Report, Kerr-McGee Radiation Sites, West Chicago, Illinois*, September 29, 1986.

serious error in estimating these background levels. Their analytical measurements, presented in Table 2-1, were insufficiently precise to actually measure the concentrations, but instead reveal only the sensitivity of the instrumentation, as clearly presented in, for example, the datum that the Rochelle Park Ra-226 contamination is "<0.7", that is, less than 0.7 pCi/g. In its calculations, however, DOE uses a background value of 0.7 pCi/g. If all one knows is that the concentration lies between zero and 0.7 pCi/g, then all values between 0 and 0.7 pCi/g have equal probability of occurring, and the most appropriate background value is the average of these, 0.35 pCi/g. This procedure is used correctly by the DOE in evaluating chemical contaminant background levels.[11] Why it is ignored for radiological contaminants is not discussed.

This error makes a substantial difference in calculations of the mean radionuclide concentrations in soils (Tables 3-4A & 3-4B). Our revised versions of these tables, where the correct background levels have been substituted for the DOE's inflated values, are included below. Our correction applies both to the "Current Use" and "Future Use" scenarios, and has a greater effect on lower concentrations. Regardless of pathways, the exposure (in mrems) will simply scale with concentration for each contaminant. Reconstruction of all the DOE's tables (Appendices C and D) is not possible here, but it is clear that the exposures will increase substantially, as much as 300% in some cases.

Cancer Risk

Even if radiation doses had been estimated properly, DOE's procedures would still underestimate the associated health risk. Following calculations of radiation dose, a factor is employed to convert radiation dose to the risk of developing fatal cancer. The risk assessment employs the latest fatal cancer risk factor derived by the National Academy of Sciences in the BEIR V report.[12] This value is based on 1986 studies of Japanese bomb survivors.[13] But, DOE reduced this risk factor with the use of a "dose reduction effectiveness factor," or "DREF," to account for the fact that the exposure rates to

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[11] BRA, p. 2-18.

[12] National Academy of Sciences, *Health Effects of Exposure to Low Levels of Ionizing Radiation, BEIR V*, National Academy Press, 1990.

[13] Shimizu, Y. *et al.*, *Life Span Study Report 11, Part 1. Comparison of Risk Coefficients for Site-Specific Cancer Mortality Based on the DS86 and T65DR Shielded and Kerma Radiation Doses*, Radiation Effects Research Foundation, 1987; and

Shimizu, Y., Hiroo, K., and Schull, W., *Life Span Study Report 11, Part 2. Cancer Mortality in the Years 1950-85 Based on the Recently Revised Doses (DS86)*, Radiation Effects Research Foundation, 1988.

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Maywood background calculations
Effect of using (upper limit)/2 for background, rather than upper limit.

Table 3-4A (revised) Mean Radionuclide Concentrations in Surface Soil, pCi/g

Locatio	Property Unit	Th-232			Ra-226			U-238		
		DOE	RWMA	Chng	DOE	RWMA	Chng	DOE	RWMA	Chng
Resid.	1	2.88	3.38	17%	0.52	0.87	67%	3.39	4.84	43%
	2	9.05	9.55	6%	1.08	1.43	32%	8.43	9.88	17%
Stepan	3	3.45	3.95	14%	0.61	0.96	57%	1.69	3.14	86%
	3H	16.33	16.83	3%	3.77	4.12	9%	4.37	5.82	33%
MunPar	4	1.21	1.71	41%	0.17	0.52	206%	0.96	2.41	151%
Com/	5	2.05	2.55	24%	0.31	0.66	113%	1.98	3.43	73%
Gov	6-MISS	7.91	8.41	6%	1.43	1.78	24%	12.78	14.23	11%
	7	18.06	18.56	3%	1.92	2.27	18%	24.27	25.72	6%
	7H	46.76	47.26	1%	4.93	5.28	7%	26.60	28.05	5%
	8	17.10	17.60	3%	1.47	1.82	24%	10.53	11.98	14%
Back-	<	1.00			0.70			2.90		
ground	=		0.50			0.35			1.45	

Table 3-4B (revised) Mean Radionuclide Concentrations in Subsurface Soil, pCi/g

Locatio	Property Unit	Th-232			Ra-226			U-238		
		DOE	RWMA	Chng	DOE	RWMA	Chng	DOE	RWMA	Chng
Resid.	1	1.57	2.07	32%	0.30	0.65	117%	2.32	3.77	62%
	2	5.53	6.03	9%	0.74	1.09	47%	5.15	6.60	28%
Stepan	3	3.46	3.96	14%	0.74	1.09	47%	1.74	3.19	83%
	3H	33.29	33.79	2%	7.06	7.41	5%	5.03	6.48	29%
MunPar	4	2.11	2.61	24%	0.11	0.46	318%	0.84	2.29	173%
Com/	5	0.68	1.18	74%	0.19	0.54	184%	1.18	2.63	123%
Gov	6-MISS	16.42	16.92	3%	2.69	3.04	13%	16.14	17.59	9%
	6H	340.28	340.8	0%	72.18	72.53	0%	99.41	100.9	1%
	6Ballod	69.81	70.31	1%	0.39	0.74	90%	84.71	86.16	2%
	7	16.50	17.00	3%	4.29	4.64	8%	31.47	32.92	5%
	7H	10.16	10.66	5%	2.11	2.46	17%	33.43	34.88	4%
	8	37.62	38.12	1%	1.97	2.32	18%	10.58	12.03	14%
Back-	<	1.00			0.70			2.90		
ground	=		0.50			0.35			1.45	

U-235 omitted since it is always 5% of U-238

persons near a waste facility are low compared to atomic bomb survivors who received large, instantaneous radiation exposures. The DREF reduces the risk factor from 8×10^{-7}/millirem to 6×10^{-7} millirem.

However, there is no human epidemiological support for DREF. Quite the opposite, studies of Hanford workers,[14] whose doses averaged about twice background, show that effects of low exposures for an extended period are comparable to and actually greater than atomic bomb survivors, for the same total dose. The Department assumes that lethal effects in human populations at low exposure rates have not been documented, but the Hanford study shows otherwise.

Studies of atomic bomb survivors are continuing, since 2/3 of the survivors of the explosion are still alive, and the cancer rates are rising as these persons reach the age when cancers are expected. If one projects into the future, it is expected that the recently increased risk factor will have to be increased once again, by a factor of 3. The results for Hanford workers would then be comparable to those for atomic bomb survivors. That is, with this more recent Japanese data, the distinction between long-term, low exposure rates and short-term, high exposure rates has vanished. The DREF should be removed from DOE calculations, and the risk factor should be 8×10^{-7}/millirem, if not much higher.

Child v. Adult Risk

DOE further underestimates the reasonable maximum cancer risk by failing to adequately distinguish between the risk to adults and children for residential properties. In general, children inhale and ingest less radioactive material than do adults, but their health risk per unit radioactivity inhaled or ingested is greater than for an adult. Children and adults receive essentially the same doses due to direct gamma radiation, but again, the risk to children for that dose is greater than for an adult. Although DOE takes some steps toward distinguishing between children and adults in its dose calculations, it does not make the distinction in all appropriate categories and fails to carry the distinction through to the calculation of cancer risk.

Although the derived estimates of exposure from most sources differ appropriately between the child and adult scenarios, the radon-222 inhalation doses presented in an

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[14] Kneale, G. and A Stewart, "Reanalysis of Hanford Data: 1944-1986 deaths," in *American Journal of Industrial Medicine*, vol. 23, pp. 371-389, 1993.

appendix are identical.[15] Radon is responsible for a significant part of the average current dose and the majority of the maximum dose, as calculated by DOE. More problematically, the authors average the child and adult doses, both for mean and maximum values, for presentation in the Risk Assessment's main text.[16] This tends to marginally diminish the estimate of the adult dose. These average doses are used in the calculation of cancer risk, using an adult conversion factor. Instead, the authors should have calculated the maximum risk using a conversion factor for the most sensitive population, namely children. Had they done so, the maximum risk would have been much higher.

Future Risk Scenarios

The worst future exposures presented by DOE are for residents on the Ballod property, who would receive an average dose of 1060 mr/year and a maximum dose of 2799 mr/year. DOE's associated estimates of cancer risk are $6x10^{-3}$ and $5x10^{-2}$ (or one chance in twenty). These estimates are high, but they and those for the other properties may be seriously underestimated. The flaws in DOE's assessment of current risk also apply to its analysis of future risk, and the Department's assumptions of future land use and contaminant fate further underestimate the risks at the Maywood site. By assuming that some of the most contaminated properties will never become residential, the authors fail to asses the reasonable worst-case scenario. As discussed previously, the Ballod and Scanel properties show the increasing trend of replacing industrial with residential properties. Also, the Department's failure to assume future movement of contaminants, as clearly demonstated at the Ballod property, contributes to the underestimation of risk. Finally, it is unfortunate that DOE does not effectively address the movement of contaminants in surface and ground water, as discussed in the "Water" section below

Future Land Use

In projecting potential cancer risk to future populations, the worst case for any of the property units would be residential use, and many of the properties are evaluated accordingly (although the difference between houses with and without basements is not explored, basements providing opportunities for greater exposure to subsurface contamination and radon). However, the Stepan and MISS properties (excepting the

[15] BRA, Appendix C, pp. C3-5.
[16] BRA, p 3-44.

Ballod property) are assumed to remain industrial. The authors' rationalization appears to be that "because DOE is responsible for the cleanup of this site and is committed to pursuing a timely response, the time period considered as the hypothetical future in this assessment . . . is the immediate future."[17] This explanation conflicts with the Baseline Risk Assessment's goal, to thoroughly evaluate the no-action alternative. There is no explanation at all as to why the Scanel properties ("Unit 8"), now vacant, could be used commercially but not as a residence

Since Maywood is located so close to New York City, it is not unreasonable to assume that the properties in question are eventually developed into a large apartment complex for commuters, that foundations are dug and the asphalt is replaced with green lawn. In this case, the direct gamma radiation, and thoron and radon releases would rise. The potential exposures and risks would greatly exceed the estimates prepared in the Maywood BRA. The historical trend in the New Jersey/NYC area is the general decline in industrial locations and the rise of service businesses and residential properties.

Maywood residents should be aware that the Maywood BRA deals with almost entirely with the individual risk to an average adult. In dealing with averages, the Maywood BRA does not consider persons with particular illnesses that make them more susceptible to the effects of radiation, such as persons with lung problems. The Maywood BRA also does not explicitly calculate the total number of expected health effects, including fatal cancers. Since the thorium wastes will remain radioactive essentially forever (thorium-232 has a half-life of 14 billion years), the total number of fatal cancers over the next 1,000 years, for example, can be quite large. The Maywood BRA is concerned with individual risks and not the total number of health effects.

Contaminant Fate

In addition to assuming that industrial properties remain non-residential, the authors assume for the MISS that the storage pile there will remain in place and remain effectively isolated from the environment. In fact, the pile is likely to be removed soon and would certainly have to be removed for any new owner to agree to buy the property, as is assumed to occur. Depending on the extent of contamination beneath the pile, gamma radiation and radon exhalation from the soil could increase without the shielding effect of the pile.

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[17] BRA, p. 1-18.

On the other hand, if the storage pile and other stored wastes are assumed to remain on site, the materials now containing them cannot be assumed to last indefinitely. However, the DOE assumes that "engineering controls and access restrictions eliminate pathways to stored waste for all except current or future employees who maintain the waste."[18] This may be plausible for the near future, but it is impossible to guarantee over the radioactive life of the stored waste, and in fact this assumption violates the basic premise of the report as stated by DOE. A realistic lifetime evaluation of the risks of these wastes must include the possibility that a few hundred years from now the waste chambers are breached and the material dispersed in the environment.

For contaminant intakes which are derived through computer models, the authors make some attempt to account for the movement of materials over time, but they do so only in the most muddled and sloppy manner. A close look at Appendix C shows that although future soil ingestion and inhalation estimates supposedly take into account the effects of erosion, only some of the values differ between the current and future scenarios. Similarly, although direct gamma and radon values calculated from soil concentrations do increase due to assumed erosion, measured direct gamma and radon values are not adjusted for the future scenarios. Future ground water contamination is also modeled, apparently assuming a single point source of radionuclides, a useless assumption in an area with such widely distributed contamination.

Water

Although ground water is not considered a vehicle for current human exposure, it has been a source of drinking water in the past and may be so again in the future. In 1984, Lodi's public water supply, specifically the Home Place well, one of 11 wells that constituted Lodi's municipal water supply, was found to be radiologically contaminated in excess of regulatory standards.[19] The head waters of Lodi Brook emanate from the Sears property, where in the past, a large amount of thorium tailings were used as fill in low-lying marshy areas. These waste materials eventually entered and contaminated Lodi Brook, but apparently are not responsible for contaminating the Home Place well.[20] Lodi Brook now consists, for the most part, of a covered culvert and Lodi now receives water

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[18] BRA, p. 3-25.

[19] Nuclear Regulatory Commission, "Public Well Above EPA Standards for Radioactivity," PNO-I-84-04, Jan 12, 1984.

[20] US EPA Region 2, "Lodi Municipal Well Superfund Site, Superfund Proposed Plan," July 1993.

from an alternate source. For future scenarios, DOE considers the Lodi water supply as "potable," though not radioactive.

In our opinion, the EPA and DOE have underestimated the potential risk posed by the Lodi municipal wells. The radioactivity in the Home Place well appears to be due to naturally-occurring uranium in the underground formations. Apparently the "hot pocket" is local, since the other wells in the Lodi system were not similarly radioactively contaminated. While we are convinced by the spectrum of radionuclides that the Lodi wells are not presently contaminated by thorium materials, for two reasons we remain concerned about future contamination.

1) Since the soil in an extensive area of the former Lodi Brook is contaminated, it remains a distinct possibility that the Lodi wells will become contaminated in the future.
2) Specific volatile organic chemicals that are present on the Stepan Company site, move much more rapidly in the environment and have contaminated all the Lodi wells. These chemical compounds (carbon tetrachloride, trichloroethene and tetrachlorethene) have also been detected in the bank of the Westerly Brook channel and Saddle River cores. Wells located upgradient from the Stepan Company site are not similarly contaminated. The presence of VOC's in Lodi wells heightens our concern that thorium and radium will similarly migrate at some later time.

Because of the presence of these VOC's in the Lodi wells, we are strongly of the opinion that the EPA erred in not identifying Stepan Company as a PRP and requiring a remediation plan for the Lodi aquifer.

It is unfortunate that the DOE has not analyzed the movement of ground and surface waters to determine whether radioactive materials continue to contaminate ground water sources. The DOE acknowledges that it has inadequate data to characterize the extent of ground water contamination. However, a plan to install new monitoring wells was blocked by citizens, who feared that the resulting wastes would not be properly disposed of. New wells are to be added when remedial action takes place at the site.

Despite the lack of data, DOE does conclude that the ground water is not now radiologically contaminated. There are two problems with this conclusion. First, the authors measured "background" contamination for ground water from two wells that are on the site, although hydrologically "upstream" of known contamination. Wells at distance of even a few hundred meters "upstream" would have been a far safer choice.

Second, this finding is based on average concentrations in contaminated areas. It would be far more convincing to see maximum values in a table, as well as the averages, as was done for radiologically contaminated soils and for the chemical analyses of water.

Chemical "Contaminants of Concern"

In selecting which chemical contaminants for which to evaluate health risks ("contaminants of concern," or COC's), the DOE does not appear to have adhered to their stated standard of keeping as a COC any contaminant whose mean concentration exceeds twice its background concentration. Table 2-4 shows arsenic with a mean background concentration of 3.3 and mean concentration in shallow soils on the MISS site of 10, three times higher than background. Yet Table 2-8 indicates that arsenic was eliminated as having a concentration less than twice background. This contradiction does not inspire confidence.

A more serious problem comes from the averaging of hundreds, even thousands, of data points into single numbers representing the contamination level of fairly large property units. This procedure certainly simplifies the risk analysis and makes the results easier to understand, but it necessarily obscures the risks arising from highly contaminated, highly localized areas within each property unit. Some serious COC's may have been missed because of this technique; the only way to be sure is to go through the data banks with a more sophisticated key than averaging.

Conclusions

The Department of Energy has underestimated current and future health risks at the Maywood site in a number of important ways. Although DOE and EPA do not intend to leave the site as it is, a more accurate assessment of the "no-action alternative" would provide a better estimate of the benefits of remediation, in terms of lives saved and illnesses avoided. In a world where no one wants to pay taxes, an underestimate of the risks at the site could lead to the allocation of inadequate funds and a slower or less thorough clean-up.

Since DOE has no obvious motivation to seek a low level of funding, we wonder why it has so seriously underestimated radiation risks. Perhaps its long history of

obscuring health risks from military operations has left the Department less able to effectively evaluate the health impacts of contaminated areas like the Maywood site. It also appears that the Risk Assessment's authors treated the report as a formality, judging from the many examples of sloppiness and inconsistency.

Finally, it is particularly important that DOE base its plans for remediation on long-term future risks rather than the short-term scenarios incorrectly employed in the BRA. For example, remediation standards should not be weakened for those areas which are assumed to remain industrial, but are likely to become residential. As the history of the Scanel and Ballod properties shows, the area is moving from light industrial to greater residential density. This is part of long-term trends in the New York metropolitan area. In our view, it is likely that more residences will be located in Maywood, considering its proximity to New York City, and these residences might be high rises. In the future, excavations for building foundations may bring radioactive materials, presently buried under asphalt, to the surface.

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