

# PUBLIC SUBMISSION

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**Docket:** NRC-2011-0012

Low-Level Radioactive Waste Disposal

**Comment On:** NRC-2011-0012-0077

Low-Level Radioactive Waste Disposal

**Document:** NRC-2011-0012-DRAFT-0138

Comment on FR Doc # 2015-06429

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## Submitter Information

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**Organization:** NIRS + over 100 organizations-see comment

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## General Comment

See 2 attached file(s) on NRC20110012; NRC20150003

10 CFR 61 Proposed Rule 10 CFR 61 Radioactive Waste Disposal Regulations

Comments Opposing Proposed NRC Regulations on so-called Low-Level Nuclear Waste Disposal which would allow more than 33 times higher radiation than from high level dumps and 20 times more than from operating nuclear power reactors.

The Comments are from over 100 organizations:

Nuclear Information and Resource Service, Physicians for Social Responsibility, Sierra Club, Friends of the Earth, Beyond Nuclear, Greenpeace, Nuclear Energy Information Service, Public Citizen, Food and Water Watch, Coalition for a Nuclear Free Great Lakes, Crabshell Alliance, Alliance for Environmental Strategies, Indian Point Safe Energy Coalition, SEED Coalition, Rachel Carson Council, Three Mile Alert, Inc., Southern Alliance for Clean Energy, Nukewatch, Public Citizen TX, Nuclear Watch South, SUN DAY Campaign, Tennessee Environmental Council, Don't Waste Arizona, Work on Waste, USA, American Environmental Health Studies Project, Inc., Citizens Allied for Clean Energy, Inc., Fluoride Action Network, Arise for Social Justice, Citizens Resistance At Fermi Two (CRAFT), New England Coalition on Nuclear Pollution,

Columbus Free Press, Alliance for a Clean Environment, California Communities Against Toxics, The Stella Group, Ltd., Natural Capitalism Solutions, North American Water Office, Ecological Options Network, Cape Downwinders, Citizens Action Coalition, Tallahassee Area Community, Utah Physicians for a Healthy Environment, Institute of Neurotoxicology & Neurological Disorders, Nuclear Hotseat, Tri-Valley CAREs, Don't Waste Michigan, Oregon and Washington Physicians for Social Responsibility Joint Task Force on Nuclear Power, Physicians for Social Responsibility-KC, San Francisco Bay Area Chapter Physicians for Social Responsibility, Physicians for Social Responsibility Western North Carolina Chapter, Environmental Priorities Network, Colorado Citizens Against Toxic Waste, Inc., Georgia Women's Action for New Directions (Georgia WAND), Concerned Citizens for SNEC Safety, California Safe Schools, Concerned Citizens of Lake Twp./Uniontown IEL Superfund Site, Pax Christi Florida, Residents Organized For a Safe Environment (ROSE), PRESS Portsmouth/Piketon Residence for Environmental Safety and Security, Grandmothers, Mothers and More for Energy Safety, Energa Ma, Chez Sven Bed & Breakfast, West Shore Unitarian Universalist Faith Communities Together Michigan Safe Energy Future, Redwood Alliance, Peace and Freedom Party, Rocky Mountain Peace and Justice Center Heart of America Northwest, San Luis Obispo Mother for Peace; Concerned Citizens Ohio/Hiram, Ohio/Shalersville Ohio Organizing Collaborative; Pilgrim Coalition, Hilton Head for Peace, Citizens for Alternatives to Chemical Contamination, Alliance to Halt Fermi 3, SBLDF, Breathe Easy Susquehanna County, RadiationTruth.org, Citizens for Clean Water, Mid-Missouri Peaceworks/Missourians for Safe Energy, Waste Action Project, Connecticut Coalition Against Millstone, Mother's Milk Project, Vermont Yankee Decommissioning Alliance, People Against a Radioactive Chesapeake The Enviro Show, Southern Maryland CARES (Citizens Against Radioactive Energy Sources), World Business Academy Peace Action Wisconsin, Peace Education Project of Peace Action, Topanga Peace Alliance, Hudson River Sloop Clearwater, Inc., Concerned Citizens for Nuclear Safety, Council on Intelligent Energy & Conservation Policy, DDMT Concerned Citizens Committee, Oregon Conservancy Foundation, Citizens for Safe Water Around Badger (CSWAB) Nuclear Age Peace Foundation, Promoting Health and Sustainable Energy, NY Citizens Environmental Coalition Lone Tree Council, Detroit Branch Womens International League for Peace and Freedom Northwatch, Durham Nuclear Awareness (DNA), Justice and Global Issues Committee Toronto South East Presbytery of The United Church of Canada Friends of Bruce

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## Attachments

100+ Groups' Comments 10CFR61 Prop Nuclear Waste Disp Regs 7-24-15 NRC-2011-0012; NRC-2015-0003 [1of2]

Washington Post Paducah Articles 1999-2000 (2 of 2; Attachment to 100+Organizations comments NRC-2011-0012)

## RulemakingComments Resource

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**From:** Diane D'Arrigo <dianed@nirs.org>  
**Sent:** Saturday, July 25, 2015 12:08 AM  
**To:** Dembek, Stephen  
**Subject:** [External\_Sender] additional commenters NRC-2011-0012; NRC-2015-0003  
**Attachments:** 100+ Groups' Comments 10CFR61 Prop Nuclear Waste Disp Regs 7-24-15  
NRC-2011-0012; NRC-2015-0003 [1of2].pdf

### Comment: NRC-2011-0012; NRC-2015-0003

Please add to the 100+ Organization Comments on Radioactive Waste Disposal Regulation

William Peil  
Calvert Citizens for a Healthy Community (CCHC).  
Lusby, Maryland

and

Ted Robinson  
Citizen Power  
Pittsburgh, Pennsylvania

Thank you

Diane D'Arrigo  
NIRS  
[dianed@nirs.org](mailto:dianed@nirs.org)  
301 270 6477 x 15

## RulemakingComments Resource

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**From:** Diane D'Arrigo <dianed@nirs.org>  
**Sent:** Monday, July 27, 2015 5:18 PM  
**To:** Dembek, Stephen  
**Subject:** [External\_Sender] 2 More additional commenters NRC-2011-0012; NRC-2015-0003  
**Attachments:** 100+ Groups' Comments 10CFR61 Prop Nuclear Waste Disp Regs 7-24-15  
NRC-2011-0012; NRC-2015-0003 [1of2].pdf

Patricia Ameno  
Citizens' Action for a Safe Environment  
Hyde Park, PA

Nancy Braus  
Clean and Green  
Brattleboro, VT

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## Comments of Over 100 Organizations\* to NRC on 10 CFR 61 Proposed Radioactive Waste Disposal Regulations

Federal Register / Vol. 80, No. 58 / Thursday, March 26, 2015 / Proposed Rules

10 CFR Parts 20 and 61 [NRC-2011-0012; NRC-2015-0003] RIN 3150-AI92

Low-Level Radioactive Waste Disposal AGENCY: Nuclear Regulatory Commission. ACTION: Proposed rule.

### New NRC so-called “Low-Level” Nuclear Waste Dump Rules Would Allow More than **33** Times Higher Radiation than High Level Dumps! And **20** Times more than from Operating Nuclear Power Reactors!

The banner on the webpage of the US Nuclear Regulatory Commission flashes “Protecting People and the Environment.” Critics of the NRC have challenged this claim and the proposed 10 CFR 61 regulation changes substantiate that challenge.

The proposed rule flies in the face of common sense and weakens already-inadequate regulations for licensed disposal of radioactive waste.

*The proposed regulations allow more than 33 times higher radioactive releases and exposures from so-called “low-level” radioactive waste dumps than from a high level waste dump* formerly proposed at Yucca Mountain. Federal regulations<sup>1</sup> for a high level waste repository allow the site to release radioactivity that would deliver doses of up to 15 millirems/year<sup>2</sup> for the first 10,000 years. From 10,000 to 1 million years, the annual dose limit is 100 millirems. The NRC proposed regulations allow 25 mr/year during operation but *up to and beyond 500 millirems per year* from so called “low-level” radioactive waste disposal sites. The proposed rule allows so-called “low-level” nuclear waste disposal sites, after closure, to emit more than 20 times more radioactivity than operating nuclear power reactors<sup>3</sup> under the Environmental Protection Agency’s regulations. 1 in 25 adults exposed to 500 mr/year will get cancer,<sup>4</sup> assuming a lifetime dose (which is permitted by the rule).

**We oppose the proposed rule 10 CFR 61 and demand that NRC actually enforce its current minimum regulations at existing sites.**

The EnergySolutions-operated site in Barnwell, South Carolina which has been leaking for decades, despite a court order against both the company and the agreement state regulator (DHEC), has no plan to stop or prevent future leakage.

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<sup>1</sup> EPA 40 CFR 197

<sup>2</sup> Millirems are units of dose that cannot be verified or enforced but that are used to justify planned routine releases from nuclear facilities.

<sup>3</sup> EPA 40 CFR 190

<sup>4</sup> 500 millirems per year for a lifetime equals 1 in 25 adults getting cancer (higher for females). Environmental Protection Agency Blue Book EPA 402-R-11-001 April 2011, Page 59: Cancer incidence risk for “age averaged” adult = 1160 cancers per 10,000 person-Gy; 1 Gy= 100 R; 1 R= 1000 mr; 0.5 R=500 mr; 1160 cancers per 1,000,000 person-R is the same as 1.16 cancers per 1000 person-R. The proposed 10 CFR 61 would allow 500 mr per year. Assuming a 70 year life, that is 500 mr x70 years = 35,000 mr over a 70 year lifetime =35 R; 1.160 cancers per 1000 person-R = X cancers per 35 person-R; X=(1.16x 35)/1000=.4060 or 40.6 in 100 or ~1 in 25. (1 millirem= 1 millirad for gamma emitters.)

The Waste Control Specialists (WCS) waste site was licensed by two out of the three politically-appointed Texas Commission on Environmental Quality (TCEQ) Commissioners, despite the technical review team recommending denial or additional changes needed to protect water. A request by the Sierra Club for a contested case hearing was denied by the TCEQ Commissioners and Sierra Club has appealed to the Texas Supreme Court, arguing that TCEQ denied a legitimate hearing request. Since the license was granted and the site started receiving commercial and federal radioactive waste, WCS has changed the license through a series of amendments. First, they asked for and received an amendment allowing disposal of waste even if water is present in the area. Second, more recently, an amendment (known as Number 26) allows the WCS to increase the amount of waste, lowers financial assurance requirements and adds new waste streams to the site, including Depleted Uranium (DU). This amendment was approved with minimal public input and allows “flexibility” for how DU is to be disposed, including potentially allowing it go into non-containerized units.

The proposed rule makes the existing 10 CFR 61 even worse and makes radioactive waste dumps more dangerous. The current rule does not require isolating the waste for the entire time it is radioactively hazardous but the proposed rule enables increasing the amount, radioactivity and longevity of the waste while removing dose limits “based on technological and economic considerations.”<sup>5</sup> *It dubs future populations “intruders” and allows unlimited doses in the future from nuclear waste generated and buried today.*

The proposed rule allows private dump-operators to do “black box” calculations to allegedly justify putting whole new kinds and amounts of radioactive wastes to existing waste sites, clearly a conflict of interest—profit for them and not in the interests of the public or environment. It overrules states that have or might set stricter than federal standards for public and environmental protection. NRC appears to be lowering its own federal standards for public and environmental protection and for democratic participation, possibly in order to facilitate weaker standards at one or more existing radioactive waste facilities. At a time when NRC should be enforcing its own administrative and technical regulations, it is weakening them.

Some of the provisions in the proposed rule violate common sense, the Atomic Energy Act, the Low-Level Radioactive Waste Policy Act, the Administrative Procedures Act, the National Environmental Policy Act and the International Declaration of Human Rights. We insist that NRC correct these errors.

Many of our groups have long advocated for better public protection in regulations for nuclear waste disposal, including:

- ➔ No waste that lasts longer than the sites are actively monitored, repaired and institutionally controlled (with resources to remediate) should be allowed into a disposal site. We support redefining “radioactive waste” eligible for shallow land burial under 10 CFR 61 and Agreement State regulations to keep long-lasting wastes out of near-surface burial.

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<sup>5</sup> Proposed 10 CFR 61.41b allows the dump operator to do a calculation projecting a dose “...level that is supported as reasonably achievable based on technological and economic considerations...”

10 CFR 61.55 Definitions: The A, B, C, >C waste classifications in 10 CFR 61.55 make assumptions that have never been publicly accepted but have become the norm. We continue to oppose the use of those misleading classifications, thus are more strongly opposed to allowing even more longer lasting and hazardous radionuclides into 10 CFR 61 disposal sites.

For example, there is no level of plutonium that is “safe” or acceptable. Yet Class A waste, supposedly only dangerous for 100 years, the shortest lasting and least concentrated class, includes plutonium-239, hazardous for a quarter to half million years, up to 10 nanocuries per gram, with no limit on the number of grams. It also includes iodine-129 hazardous for 160 to 320 million years. Clearly adding the proposed DU which decays into other, even longer-lasting radioactive elements, with its long decay chain has no business in 100 year Class A disposal.

- ➔ NRC should define the appropriate class, if there is one, for DU. Initiate plans to consider it as high level waste.
- ➔ Keep uranium (including DU), irradiated fuel reprocessing waste (including WIR--Waste Incidental to Reprocessing—a downward reclassification of high level waste), and other long-lasting wastes out of so-called “low-level” waste 10 CFR 61 disposal sites.
- ➔ Make a goal of isolating radioactive waste, not legalizing releases. Do not increase allowable radioactive releases or the projected doses to people during or after the operational period.

Under the existing 10 CFR 61 the sites can legally leak into “the general environment in ground water, surface water, air, soil, plants and animals,” an amount calculated to deliver up to 25 millirems to the whole body, 75 millirems to the thyroid and 25 millirems to any other organ of the body of members of the public, annually. By adopting the 10 CFR 20 definitions of radiation dose (doing away with organ dose limits), the proposed rule increases the radioactivity per millirem for many of the radionuclides. The proposed rule makes this much worse, as it allows not 25 but up to 500 millirems (EDE) or more per year, from a *closed* site. The unspecified doses are based on technical and economic considerations of the waste site operator. See the proposed 10 CFR § 61.42. 500 millirems/year is an amount that is expected to cause cancer in 1 in 25 exposed<sup>6</sup>, clearly an unacceptable risk from closed nuclear waste sites. This is criminal and disgraceful for an agency claiming to protect the public and environment.

The existing radioactive waste sites have historically leaked – some in less than 20 years and well before site closure. One can only hope that institutional controls will exist for 100 years post-closure, keeping in mind that institutional controls are not accompanied by resources to capture or control leaks and releases when they are revealed.

- ➔ No Preemption of State Authority; Require States to Regulate as Strictly as NRC -

The proposed rule supersedes the rights and authority of states to set more protective standards for facilities in their boundaries by making the entire 10 CFR 61 Level B

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<sup>6</sup>Op.cit.4

Compatibility. As public interest advocates who participated in the setting of state regulations and siting of radioactive disposal sites, we strongly oppose this compatibility designation and support and encourage all state level opposition to this designation.

NRC should drop the proposed requirement that all provisions of the new rules be adopted verbatim, Level B Compatibility, by Agreement States. The 'Low-Level' Radioactive Waste Policy Act and its Amendments (PL 99-240) makes states responsible for so-called "low-level" radioactive waste that is generated within their boundaries (although the provision requiring states to take title to the waste if disposal was not provided was overruled by the US Supreme Court in 1992). NRC should not undercut states by preempting their ability to set standards that are more protective than federal requirements. This undercuts states' ability to be responsive to its citizens and residents.

NRC should retain and expand the ability for states to be more protective, to regulate more strictly than the federal 10 CFR 61 regulations. This was part of the commitment and incentive to encourage and enable states to site new nuclear waste disposal sites. Changing the rules now looks a lot like a broken promise. It is predicted that there will be a need for new waste sites in the decades to come. Reneging on previous commitments and insisting that states adopt the more lax regulations that NRC is proposing will make that more difficult.

Rather than relaxing standards and advocating for more hazardous and long-lasting waste going into waste sites, the US NRC, at minimum, should be enforcing the existing requirements and regulations and holding states to those.

In cases in which the state or states that are increasing the risks to the public or providing weaker protections than 10 CFR 61 currently allows, NRC should assert its authority to maintain federal standards and require Agreement States to do so. This rulemaking appears to be an effort by NRC to join the lower common denominator, at least with DU, projections of long term doses from closed facilities and possibly other provisions.

➔ "Below Regulatory Concern-"

deregulates, exempts and releases radioactive waste and materials from radioactive regulatory control. NRC under its 10 CFR 20.2002 process allows radioactive waste, material and sites to be managed without radioactive regulatory controls on a case by case basis. Applications for these exemptions are not easily publicly available thus devoid of necessary options for public input and intervention. We are not aware of public reporting of 10 CFR 61.6 applications and call on NRC to stop treating nuclear waste, property and materials as if not radioactive whether it goes to solid, hazardous or other facilities and especially if it is allowed into the recycling streams or is released for unrestricted or restricted use.

DELETE the added phrase in proposed rule under §61.7 Concepts ... "Alternative methods of disposal may be approved on a case-by-case basis as needed under § 61.6." (*Page 9 of the Comparison between Current Rule Language and Rule Language in Proposed Rule, "Low-Level Radioactive Waste Disposal" (80 FR 16082)*). The NRC



must not forget that the American public and our elected officials have repeatedly rejected the deregulation of nuclear waste. It should not be inserted into this rule which is about licensed radioactive disposal. The proposed rule re-asserts the publicly rejected concept of deregulation and we demand the deletion of this and any provisions that allow for manmade radioactive waste, materials, emissions and practices to be released from **radioactive** regulatory control. Deregulation, release, exemption, clearance and de minimus are completely unacceptable.

DELETE the existing § 61.6 Exemptions<sup>7</sup> from the regulations. If it is retained, at minimum, CLARIFY that there must be advance public notice, comment and opportunity for hearing, adjudicatory hearing and intervention, as with other license amendments and changes in regulations. Public notice, comment and opportunity for intervention should be required for any and all exemption, clearance, release of radioactive waste or materials from radioactive regulatory control.

➔ We oppose increasing the amount and longevity of radioactivity that goes into shallow land burial.

The proposed rule would allow even longer-lasting waste into unlined soil trenches than the current regulations—waste that will be dangerous much longer than the sites will be controlled or monitored. These include:

- Plutonium-239 (240,000 to 480,000 year hazard) and iodine-129 (160 to 320 million year hazard) from nuclear power reactors are already allowed in set concentrations in dumps that can be institutionally controlled for up to just 100 years. Sierra Club and other public interest and environmental groups have called for limiting the waste that can go into these dumps to that which is hazardous for 100 years or less. Pennsylvania extended the institutional control period so if a facility is opened in that state, the site would be tracked longer than NRC assumes. Rather than consider the public demands for letting only shorter-lasting waste into the burial grounds, NRC is now opening the door to very large amounts of long-lasting waste and waste that gets more radioactive as it decays into other more radioactive materials. We direct that NRC analyze and adopt stricter disposal site requirements, keeping long-lasting waste out of shallow burial sites.
- Uranium, referred to as Depleted Uranium (DU) after much of the uranium-235 is removed to make nuclear power and weapons fuel, because it is “depleted” of that one isotope, is biologically hazardous and radioactive due to all the other uranium isotopes present and the decay products of those isotopes increase in radioactivity over time. Thus DU can deliver increasing doses to the public, giving the peak or highest dose in more than 2 million years. (See <http://www.deq.utah.gov/businesses/E/EnSolutions/depleteduranium/> and <http://www.healutah.org/campaigns/nuclear-utah/nuclear-waste/> ) We support

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<sup>7</sup> Existing regulation: 10 CFR § 61.6 Exemptions. The Commission may, upon application by any interested person, or upon its own initiative, grant any exemption from the requirements of the regulations in this part as it determines is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest.

HEAL Utah, Institute for Energy and Environmental Research's (IEER) and all other technical comments throughout this entire rulemaking process against allowing DU into shallow land burial sites and opposing its de facto inclusion in Class A with no justifiable, technical analysis. NIRS and IEER challenged the commercial generation of more DU during the licensing of the LES uranium enrichment facility now operating in New Mexico. We continue to hold that DU is not "low-level" waste or Class A, and that there is no safe permanent way to "dispose" or isolate it from the public and the environment. Because of the longevity of the hazard, it must be considered high level radioactive waste, or at least Greater than Class C, unsuitable for shallow land burial. We oppose the default and pretense NRC is making to allow it into shallow land burial where it cannot be isolated for the length of its hazard.

- "Dirty" DU:  
So-called Depleted Uranium or DU could have and has had fission products present which exacerbate the health effects even further. Uranium recovered from the reprocessing of highly radioactive irradiated nuclear fuel, became highly radioactive and was sent back through enrichment facilities without notifying or protecting the workers from this deadly additional hazard. The DU generated during that subsequent enrichment processes was contaminated with fission products as well as the heavier transuranic residue that came with the "dirty" uranium. Absolutely no calculations have been done for this rulemaking by NRC nor are there requirements for disposal licensees to include such information in their Performance Assessments.

This is a clear example that the process will not protect the public and environment. There is no justification for failing to incorporate this reality into the rulemaking, further discrediting the inadequate assessments of harm this proposed rule presents.

We submit as attachments to these comments emails between NIRS and NRC regarding this omission including the actual Washington Post investigative reports on this scandal which resulted in involuntary, uninformed exposures of workers to fission products at enrichment facilities and failure to provide protection. Many other parameters of the Performance Assessments would change with this correction. Accurate inclusion of this "dirty" DU must be required in the assumptions NRC Staff and disposal companies have made about inadvertent intruder doses and the timeframes and amounts of "peak exposure." There may be several peaks that should be factored.

- High level radioactive waste from reprocessing of irradiated fuel—dubbed "Waste Incidental to Reprocessing" or even other high level waste could theoretically be disposed in shallow land burial grounds. Commercial reprocessing is not happening now in the US and NRC should not change its rules to accommodate reprocessing.

In 2002 NRC had to admit that the only commercial reprocessing site in the US, at West Valley, NY, which only operated for 6 years, could not comply with the NRC License Termination Rule (10 CFR 20 subpart E), thus stated that it would require significant “flexibility.” In the intervening years, DOE’s has solidified much the primary extraction liquid into 275 high level radioactive waste “logs” at West Valley and generated huge amounts of waste in other waste streams with unknown but large amounts of radioactive sludge in underground tanks. It is been projected to cost roughly \$5 Billion to clean up the reprocessing waste part of the site and another ~\$5 Billion to clean up the commercial “low-level” radioactive burial ground, which operated for about a dozen years, at West Valley. NRC is failing to consider the long term costs of its weakened 10 CFR 61 regulations as it facilitates new reprocessing and waste sites that can take more kinds of waste.

- Other “unique” waste streams never originally intended for such unlined shallow land burial grounds have no business being thrown in the ground at the behest of the profit-making operators of waste sites. We understand that NRC wants to “solve” as many waste problems as it can, but pretending burial will isolate waste, and removing dose limits that could prevent burial are not acceptable. We demand that NRC strengthen the dose limits...make them low enough to protect the reproductive stage of our life cycle from not only cancer but all other radiation-induced negative health effects, including but not limited to teratogenic and genetic.
- Blended waste and Averaging

Years after the 1982 rule 10 CFR 61 was adopted, NRC reinterpreted that rule to mean that classifying of waste (into A, B, C or >C) should be done at the point of disposal. This facilitated all sorts of waste processing, largely done in Tennessee but also in other states including Ohio. This has led to unnecessary transport and routine radioactive releases to the environment around processing facilities. A disturbing idea is being considered of bringing waste to disposal sites and then mathematically averaging the amount of radioactivity with the amount of radioactivity already at the site to allow much more radioactivity and higher concentration waste to be buried. We object to these practices.

- ➔ NRC is not abandoning the A B C and >C concentration tables 10 CFR 61.55 but providing many other methods to comply and apparently leaving it up the waste operator, not the state or the public.
- ➔ NRC creates and exacerbates a serious conflict of interest by encouraging and permitting profit-making dump-operators to do their own computer models and projections to allow more radioactive and longer lasting waste into trenches. NRC’s claim that computer-generated “Performance Assessments” can predict a “Safety Case” is false. Increasing hazards does not provide greater protection.

- NRC admitted that it had not considered that some uranium is laced with fission products. As we stated above, some reprocessed uranium was put through uranium enrichment facilities. NRC should be aware of this well documented and publicly disclosed history at Paducah and reflect it and other such historical knowledge. It is not clear if other sites may also have similar wastes, and certainly if the ill-advised prospect of reprocessing is pursued, there will be more.
- NRC admits that Waste Incidental to Reprocessing possibly could go to shallow land burial.
- Greater-than Class-C waste and Transuranics above 10 or 100 nanocuries per gram, previously guaranteed NOT to go to these facilities would be allowed.
- Dump operators will make more money; generation of more new waste will be encouraged; the public will not be protected. The NRC, some Agreement state regulators and the waste site operators are making no “safety case” for us, the public.

➔ NRC’s proposed rule would allow higher amounts of radioactive exposure --higher doses and in some cases, unlimited radiation doses to the public, as mentioned above.

- First, this done by “updating,” using a different way to calculate doses which allows *more radioactivity per millirem* or unit of dose for many of the radionuclides. Depending on which radionuclides are being considered, there can be different amounts in each new *millirem EDE* (the ‘updated’ dose units) than in each of the existing millirems in the current rule. Neither of these are ever measured, verified or enforced. They serve to justify allowing more radioactivity in the waste and waste sites. We oppose the adoption into 10 CFR 61 of the 10 CFR 20 methods of dose calculation in all cases that increase radioactivity per millirem, or increase allowable concentrations, releases and exposures.
- Second, NRC is increasing and allowing unlimited millirems/year. The existing rule limits doses to the public during operations to 25/75/25 millirems per year and does not expressly specify higher amounts post-closure. This would be an enormous relaxation of the standards and must be dropped.

NRC opening these sites to DU is a mistake since the radioactivity/radiation levels will rise over time. At one time DU was expected to be part of wastes that should be permanently isolated from our environment like irradiated fuel. NRC should adopt that plan for DU.

➔ Radiation is more dangerous for females, youth, and threatens the reproductive stage of the human and other life cycles.

The proposed rule ignores the now-known reality that external ionizing radiation causes 50% more cancer and fatal cancer in female adults compared to male adults and 7 times

more cancer incidence when the exposure happens in very young females, compared to exposure of adult males.<sup>8</sup> Young males and females are both at higher risk, but half of the global population needs greater protection and NRC dodges this in its role as regulator. This is irresponsible. Juvenile females are not a “subpopulation” they are an inextricable link in the human lifecycle. There is no biological “Reference Man” who did not come from someone who was in this most sensitive age group. NRC continues to unacceptably ignore non-cancer health effects, synergistic effects with other toxic exposures and reproductive effects.

- ➔ NRC should not “*update*” the radiation dose part of this regulation 10 CFR 61 by incorporating its 10 CFR 20 standards because those are *less protective* than 10 CFR 61 current limits. Any change should “update” the scientific reality that radiation is more harmful than previous assessments identified and *reduce allowable releases and exposures*.

NRC is failing to protect the reproductive phase of the human lifecycle (and that of all other species as well). We have commented on this in the 10 CFR 20 rulemaking and oppose expanding those failures to protect from radiation into this regulation 10 CFR 61. Radiation is clearly being found to be more harmful every time it is reviewed (rather, each batch of new data shows that regulators have failed repeatedly to honestly report the true hazards of ionizing radiation) yet NRC stubbornly moves to let the radioactive pollution levels rise as it increases allowable concentrations and emissions into air and water and doses to this and future generations. Scientifically, it is unacceptable.

- ➔ There is no meaningful limit on the Performance Assessment. Allowing the option of the waste site operator choosing his or her own allowable dose level, means pretty much any kind of waste can go to these sites. This is worsened by the fact that allowable dose limits are used for calculations only, never enforced or verified; It is not scientifically justifiable for NRC allow Performance Assessments and Safety Cases to be done by those who stand to profit, inevitably allowing more dangerous and long lasting wastes into shallow land burial sites.

It is a conflict of interest to allow those who profit from disposal, the waste site owners and or operators, to do essentially “black box” calculations to allow more dangerous nuclear waste into their own facilities. The rule should not have this provision and any provision it does have should have a requirement for public notification, comment, intervention and intervenor funding.

- ➔ The Emergency Access Clause, Section 6 of the Low Level Radioactive Waste Policy Act, provides that in emergency situations, operating nuclear waste facilities could be required to take waste not normally designated or intended. We have always contended

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<sup>8</sup> See: “Atomic Radiation is More Harmful to Women” October, 2011:  
<http://www.nirs.org/radiation/radhealth/radiationwomen.pdf> as well as other items on radiation and gender posted:  
<http://www.nirs.org/radiation/radhealth/radhealthhome.htm>

that sites must not be required, forced, or allowed to take wastes for which they were not originally intended or characterized. The proposed regulations could do the exact opposite, provide for any kind of radioactive waste to be accepted. Under the Environmental Protection Agency's Protective Action Guides, such facilities could be expected to take large amount of waste from emergencies. States should not be forced to accommodate the nuclear industry polluters in this way. It is time for the federal regulators to adopt a role of incentivizing waste reduction, not the opposite.

- ➔ Performance Assessments are tools that can easily be used to justify polluting practices and facilities, not just radioactive. They are not practically transparent or reviewable by the public. We support HEAL Utah's comments on 10 CFR 61 against Performance Assessments.

Performance Assessments are only predictions and especially not trustworthy when carried out by those who stand to profit from the conclusions.

NRC highlights the Performance Assessment proposed for the West Valley nuclear waste site in its 10 CFR 61 Technical Guidance,<sup>9</sup> but the public opposes the Performance Assessment being planned for that site because the Agencies responsible refuse to provide transparency and the public is being denied input on the contractor, real time access to the necessary assumptions, documents, expert declarations, computer programs and codes and resources to hire independent reviewers. The West Valley experience should be a warning for communities and states where other nuclear waste sites are located. The site itself has been estimated to cost \$9.7 to \$10 billion to fully clean up and it threatens to release its contents into the surrounding streams and the Great Lakes. The performance assessment is being carried out to justify leaving waste in rapidly eroding unstable ground.

- ➔ Both the current and proposed 10 CFR 61 allow for unlined soil trench burial of radioactive wastes that will inevitably leak out. Both fail to protect the public. The current regulations should be strengthened and the proposed rule which allows higher radiation exposure to the public than operating nuclear reactors or a high level radioactive waste repository should be scrapped.

Submitted by Over 100 Organizations\* listed below, pages 11-15.

Contact: Diane D'Arrigo, Nuclear Information and Resource Service [dianed@nirs.org](mailto:dianed@nirs.org)

Attachments: NRC-NIRS Correspondence re Washington Post series on fission product and transuranic contamination at uranium enrichment facilities and in depleted uranium; Washington Post series (by separate submission on regulations.gov)

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<sup>9</sup> D. Esh, C. Grossman, H. Arlt, C. Barr, P. Yadav, "Guidance for Conducting Technical Analyses for 10CFRPart 61." Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, 2015.  
<http://pbadupws.nrc.gov/docs/ML1505/ML15056A516.pdf>>.file:///U:/My%20Documents/LLRW/10-cfr-part-61%20redline%20changes.pdf

## 100+ Organizations

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Physicians for Social Responsibility  
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Arlington, VA

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Natural Capitalism Solutions  
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Mary Beth Brangan  
Ecological Options Network  
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Diane Turco  
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**ATTACHMENT 1 to 100+ Organizations' Comments to NRC on 10 CFR 61 Proposed Radioactive Waste Disposal**

**Regulations From:** "Grossman, Christopher" <[Christopher.Grossman@nrc.gov](mailto:Christopher.Grossman@nrc.gov)>

**Date:** June 16, 2015 at 2:56:18 PM EDT

**To:** "'[maryo@nirs.org](mailto:maryo@nirs.org)'" <[maryo@nirs.org](mailto:maryo@nirs.org)>

**Cc:** "Dembek, Stephen" <[Stephen.Dembek@nrc.gov](mailto:Stephen.Dembek@nrc.gov)>, "McKenney, Christopher" <[Christopher.McKenney@nrc.gov](mailto:Christopher.McKenney@nrc.gov)>, "Yadav, Priya" <[Priya.Yadav@nrc.gov](mailto:Priya.Yadav@nrc.gov)>, "Comfort, Gary" <[Gary.Comfort@nrc.gov](mailto:Gary.Comfort@nrc.gov)>, "Esh, David" <[David.Esh@nrc.gov](mailto:David.Esh@nrc.gov)>

**Subject:** Correction Regarding a Question at June 2, 2015 10 CFR Part 61 Public Meeting in Columbia, SC

Ms. Olson -

During the June 2, 2015 public meeting on the rulemaking for 10 CFR Part 61, you inquired about whether U.S. Nuclear Regulatory Commission (NRC) staff considered contaminated depleted uranium from U.S. Department of Energy (DOE) facilities in its analysis to support the Commission Paper, SECY-08-0147. In response at the meeting, I replied that we had considered contaminated depleted uranium. I have had some time to review our analysis and would like to correct my response to your question. While we considered the quantities of depleted uranium associated with DOE's facilities in the analysis, we, in fact, did not consider radionuclides associated that might result from contamination of depleted uranium with reprocessed materials at DOE facilities. Rather our analysis only considered radionuclides associated with clean depleted uranium. As indicated during the meeting, Enclosure 1 to SECY-08-0147 includes a description of our analysis including the specific radionuclides considered.

I apologize for any confusion my response may have created. NRC staff plans to correct the public record in the future, but I wanted to let you know personally as the originator of the question. In the near future, staff will also be placing this email in the NRC's Agencywide Document Access and Management System (ADAMS) and on the NRC's Low-Level Radioactive Waste Disposal public website for the 10 CFR Part 61 rulemaking. ADAMS is available at <http://www.nrc.gov/reading-rm/adams.html>. NRC's 10 CFR Part 61 rulemaking public website is available at <http://www.nrc.gov/about-nrc/regulatory/rulemaking/potential-rulemaking/uw-streams.html>. You will be able to find it under "2015 Public Workshop Information", "Public Meeting 5 — June 2, 2015 (Columbia, SC)" once it is available. If you have any further questions about our analyses or the rulemaking, please feel free to contact me or any of the project managers for the rulemaking.

Respectfully,

Christopher J. Grossman

Risk Analyst

Division of Decommissioning, Uranium Recovery, & Waste Programs

Office of Nuclear Material Safety and Safeguards

U.S. Nuclear Regulatory Commission

301-415-0140

[christopher.grossman@nrc.gov](mailto:christopher.grossman@nrc.gov)

From: Mary Olson  
Sent: Thursday, June 18, 2015 9:46 AM  
To: Grossman, Christopher  
Cc: Dembek, Stephen; McKenney, Christopher; Yadav, Priya; Comfort, Gary; Esh, David; Tim Judson; Diane D'Arrigo  
Subject: RE: Correction Regarding a Question at June 2, 2015 10 CFR Part 61 Public Meeting in Columbia, SC

Second Reply:

Mr. Grossman,  
Cc above list; adding Diane D'Arrigo and Tim Judson at NIRS,

I would like this reply, and the attached document to be also posted with public access in ADAMs.

I asked NRC the question about whether it had considered DU (Depleted Uranium) originating from Paducah (and possibly other process sites) because of the history of the US Department of Energy sending uranium from plutonium separation (reprocessing) back through the enrichment phase as documented in the attached file by the "Paper of Record" the Washington Post. The uranium that was sent back through post-reprocessing was laced with fission products and activation products, including plutonium and other transuranics.

In its discussion of the proposed changes to Part 61, which anticipate the inclusion of DU in so-called "low-level" radioactive waste trenches, NRC has assumed that the DU is pure U238 and while somewhat radioactive itself would only contribute other radioactivity as decay products over time (a long time) to the inventory at the site.

The DU from Paducah is not pure DU. The enrichment process results in a more pure U235, not a more pure U238.

The attached file contains a series of 9 articles that together are the report of an independent investigation of the impact of the contaminated uranium on workers at Paducah. The impacts were not trivial. It is very important that NRC as a regulator not fall into the trap of using broad assumptions that are purely theoretical with no "process history."

A broad policy change such as proposing to call material with a 4.5 billion-year half-life "low-level," should not overlook the actual history of this material, nor the possible implications for the future since reprocessing is one of the reasons NRC cites for making changes at this time. An inventory of cesium, strontium and plutonium as well as the rest of the fission-product soup riding as "hitch hikers" on uranium must be factored since the impact would be today, not in the distant future of radioactive decay.

I am sure that the over-all plan to allow the dump-operator to make a “safety case” will compensate for any possible material that it wants to bury...but, on behalf of the drivers, waste handlers, dump workers, and the groundwater, please do not assume all DU is only U238.

Sincerely,  
Mary Olson

Mary Olson  
maryo@nirs.org  
NIRS Southeast www.nirs.org  
828-252-8409 / 828-242-5621 cell

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**ATTACHMENT 2 to 100+ Organizations’ Comments to NRC on 10 CFR 61 Proposed Radioactive Waste Disposal being submitted separately as support for the concerns raised in these comments.**

The 9 Part Washington Post Series re Uranium Enrichment

The Washington Post, Joby Warrick, Washington Post Staff Writer

August 8, 1999 through February 11, 2000

**In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant**

**Richardson Orders Probe Of Uranium Plant in Ky.**

**A Deathly Postscript Comes Back to Life; After Being Rejected, Warnings of Paducah Atomic Worker Now Hailed as Heroism**

**Paducah's Silent Witness; Excessive Uranium Level Found in Worker's Bones**

**U.S. Will Propose Payments to Sick Paducah Workers; \$20 Million Fund Eyed For Radiation Cancers**

**Radiation Risks Long Concealed; Paducah Plant Memos Show Fear Of Public Outcry**

**Energy Dept. Faults Paducah Contractors; Deficient Plant Hazard Warnings Cited**

**Plant Hid Risk From Workers; Paducah Bosses Knew Some Had High Radiation Levels**

**Bomb Part Storage at Ky. Plant Disclosed; Nuclear Agency Is Told of Hazards In Secret Program**

1 of 9 DOCUMENTS

The Washington Post

August 8, 1999, Sunday, Final Edition

## In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant

**Joby** Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A01

**LENGTH:** 4790 words

**DATELINE:** **PADUCAH**, Ky.

Thousands of uranium workers were unwittingly exposed to plutonium and other highly radioactive metals here at a federally owned plant where contamination spread through work areas, locker rooms and even cafeterias, a Washington Post investigation has found.

Unsuspecting workers inhaled plutonium-laced dust brought into the plant for 23 years as part of a flawed government experiment to recycle used nuclear reactor fuel at the **Paducah** Gaseous Diffusion Plant, according to a review of court documents, plant records, and interviews with current and former workers. The government and its contractors did not inform workers about the hazards for decades, even as employees in the 1980s began to notice a string of cancers.

Radioactive contaminants from the plant spilled into ditches and eventually seeped into creeks, a state-owned wildlife area and private wells, documents show. Plant workers contend in sealed court documents that radioactive waste also was deliberately dumped into nearby fields, abandoned buildings and a landfill not licensed for hazardous waste.

The sprawling Kentucky plant on the Ohio River represents an unpublished chapter in the still-unfolding story of radioactive contamination and concealment in the chain of factories across the country that produced America's Cold War nuclear arsenal. Opened in 1952 in an impoverished region, the 750-acre plant built a fiercely loyal work force of more than 1,800 men and women who labored in hot, stadium-sized buildings turning trainloads of dusty uranium powder into material for bombs.

Today, the Department of Energy contends that worker exposure was minimal and that contamination is being cleaned up. A lawsuit filed under seal in June by three current plant employees alleges that radiation exposure was a problem at **Paducah** well into the 1990s.

The Post's investigation shows that contractors buried the facts about the plutonium contamination, which occurred from the mid-1950s to the mid-1970s, in reports filed in archives. Plutonium, a core ingredient in nuclear bombs, is a highly radioactive metal that can cause cancer if ingested in quantities as small as a millionth of an ounce. The **Paducah** plant was designed to handle only uranium, a mildly radioactive metal.

"The community to this day has no idea of the kinds of contaminants they were exposed to," said James W. Owens, a **Paducah** lawyer representing residents whose water has been polluted by the plant.

Health consequences remain unclear. No comprehensive study of worker medical histories has been attempted at **Paducah**. In neighborhoods where older workers live, stories abound of cancer clusters and unusual illnesses. One 20-year veteran worker who died in 1980 compiled a list of 50 employees he worked with who had died of cancer.

In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant The Washington Post August 8, 1999, Sunday, Final Edition

"Everything was so safe, so riskless," the worker, Joe Harding, said in an interview just before his death. "Today we know the truth about those promises. I can feel it in my body."

Even though the plant's procedures and purpose have changed -- **Paducah's** enriched uranium is now used in commercial nuclear power plants -- problems have continued. Workers weave between makeshift fences that cordon off hundreds of radioactive "hot spots" scattered across the complex. In one corner of the plant, mildly radioactive runoff trickles from a nearly half-mile-long mound of rusting barrels that still contain traces of uranium.

"The situation is as close to a complete lack of health physics as I have observed outside of the former Soviet Union," Thomas Cochran, nuclear program director for the Natural Resources Defense Council, said in documents filed in the lawsuit.

The Department of Energy, which owns the plant, said it could not comment on allegations made in the suit because of the court-ordered seal. The agency is investigating the charges and dispatched a team to **Paducah** to determine if conditions posed an immediate threat to workers or the public.

Energy Secretary Bill Richardson said the agency's national security goals had "sent many of our workers into harm's way," but he said the agency must now live up to its responsibility to "right the wrongs of the past." Two weeks ago, Richardson pledged millions of dollars for medical monitoring of nuclear workers who were exposed to beryllium, a highly toxic metal.

"The Department of Energy will continue to take any actions that are necessary to ensure the protection of public health, the workers and the environment," he said.

Still, agency officials, in a written response to questions from The Post, strongly defended past safety practices at **Paducah** and said no workers are at risk today.

"The plant's monitoring data did not indicate an accumulation of [plutonium and other highly radioactive wastes] in the workplace or the environment that would be a health concern to workers or to the public," the DOE said.

That position is vigorously contested in more than 2,000 pages of documents filed in the lawsuit by two of the plant's health physicists, or radiation safety experts, and a veteran worker who had his esophagus removed after three decades of work inside contaminated buildings. Copies of the documents were obtained by The Post from government sources.

"The management line for years has been there was an insignificant amount" of plutonium at **Paducah**, said Mark Griffon, a health physicist at the University of Massachusetts at Lowell who is participating in a federal study of radiation conditions at nuclear weapons plants, including **Paducah**. Griffon reviewed plant documents provided by The Post.

"If the levels were this significant," he said, "it raises an important question: Why weren't workers ever monitored?"

The two health physicists suing the plant say in court documents they tried to call attention to the radiation problems but were confronted by a culture of unconcern.

"I was told by my superior . . . in so many words that 'this is **Paducah** -- it doesn't matter here,' " said one of the physicists, Ronald Fowler, 50, who came to the plant in 1991.

The suit was brought under a law that allows employees to collect payment for exposing fraud against the government. It was filed under seal to give Justice Department officials an opportunity to decide whether to join the suit or begin a criminal investigation.

The suit names Lockheed Martin and Martin Marietta, which managed the uranium enrichment plant during the 1980s and 1990s. It does not name the original manager, Union Carbide, which ran the facility for a 32-year period during which the bulk of the contamination occurred. None of the companies had been served with the suit and none would comment on the allegations.

The current plant operator, U.S. Enrichment Corp., a government-chartered private company that assumed management this year, concedes past problems but says safeguards are now in place. USEC, which sold



In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant The Washington Post August 8, 1999, Sunday, Final Edition

shares to the public last year, says it has fully disclosed the plant's environmental problems to regulators, workers and stockholders.

"It was acknowledged by all sides that contaminated conditions existed, . . . but USEC wasn't responsible for them," said Jim Miller, USEC executive vice president.

**Paducah** is the latest DOE facility to be rocked by lawsuits and revelations of contamination. Cleaning up the complex is expected to cost \$ 240 billion and take at least 75 years.

Measured by the gram, the contamination at **Paducah** isn't nearly as extreme as that in plutonium production plants such as Washington state's Hanford Nuclear Reservation, where vast swaths of land have been sealed off from humans. But unlike the workers at those plants, employees at **Paducah** did not know of the risks in the uranium dust they breathed every day.

Worker exposure to such dust has cost the government in the past. The Energy Department paid a \$ 15 million settlement five years ago to former workers who had breathed uranium dust at the Fernald Feed Materials Production Center near Cincinnati.

The difference between the dust at Fernald and that at **Paducah** comes down to one word: plutonium.

For 2 Decades, Freight Cars

Brought Unknown Danger

The **Paducah** complex was the second of three U.S. government plants designed after World War II to create enriched uranium. The plants were operated for the government by private contractors who over time were paid bonuses for running safe, efficient facilities.

In the beginning, uranium ore was scarce. The Atomic Energy Commission, forerunner of today's Energy Department, tried to fill the gap by "recycling" leftover uranium -- from nuclear reactors that made plutonium for bombs -- through the enrichment process at **Paducah**.

From 1953 to 1976, more than 103,000 metric tons of used uranium was shipped to **Paducah**, records show. It arrived in freight cars as a fine black powder. Unknown to workers, the powder contained dangerous substances left over from the plutonium-making process -- fission byproducts such as technetium-99 and heavy metals known as "transuranics": neptunium and plutonium.

"Plutonium is roughly 100,000 times more radioactive per gram than uranium," said Arjun Makhijani, president of the Institute for Energy and Environmental Research.

Over time, through spills and waste discharges, the contaminants accumulated in the miles of pipes used to gasify and enrich uranium, around loading docks and in ditches, documents show.

Plant officials were aware of the plutonium and other contaminants as early as the mid-1950s -- it made their recycled uranium less efficient. But they believed the amounts were too small to pose a health threat.

Today, the DOE is able to rely only on a contractor's estimate of the total amount of contaminants introduced in that period: 12 ounces of plutonium, 40 pounds of neptunium and 1,320 pounds of technetium-99.

The government today takes the same position as it did in the 1950s: The amounts were most likely not enough to harm workers. "The general protection provided to workers from the hazardous effects of uranium would have provided adequate protection" from the contaminants, the DOE statement said.

But documents obtained by The Post show that plant officials became increasingly concerned about the contaminants. A 1992 report by Martin Marietta concluded that they caused "significant" environmental problems and "also pose a radiation hazard to the workforce." A 1988 study done for the DOE by a private contractor said the plutonium could "represent a significant internal dose concern even at very low mass concentrations."

Plant records draw an instructive comparison that underlines the hazards posed by plutonium: The 12 ounces of plutonium in the black powder delivered more than twice as much radiation into the environment as the 61,000 pounds of uranium that flowed out of the plant in waste water into the Ohio River between 1952 and 1987.

In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant The Washington Post August 8, 1999, Sunday, Final Edition

## Bosses Took Threat

### With a Grain of Salt

In the noisy, cavernous buildings where uranium was processed, workers did not receive the warnings. The conditions there were "extremely dusty . . . sometimes to the point where it was very difficult to see or breathe," said Garland "Bud" Jenkins, 56, a 31-year-veteran uranium worker and one of the three employees involved in the lawsuit against Lockheed Martin.

To protect their skin from the uranium dust, workers wore cotton coveralls and gloves. But respiratory protection was optional -- old Army gas masks, which fit poorly and were seldom used, former and current workers said.

At lunchtime, workers brushed black powder or green uranium dust off their food. "They told us you could eat this stuff and it wouldn't hurt you," said Al Puckett, a retired union shop steward. To dramatize the point, he said, some supervisors "salted" their bread with green uranium dust.

The workers took the dust home at shift's end.

"We frequently discovered that our bed linens would be green or black in the morning, from dust that apparently absorbed into our skin," Jenkins said.

Exposure to uranium dust decreased after the late 1970s, when the plant stopped receiving the black powder and began processing a more refined form of uranium. In 1989, the DOE adopted more stringent worker safety rules.

By then the plutonium had permeated the land around the plant. In the 1960s and 1970s, when the powder spilled, workers would shovel it up and wash the remnants into the nearest ditch, Jenkins said. More than a dozen ditches flow directly from the plant onto state property and private lands.

There are no nationwide limits for plutonium in soil; cleanup standards depend on modeling the degree of public access to the contaminated spot. But the DOE has set cleanup limits at nuclear blast sites in the South Pacific of 15 picocuries of plutonium per gram of soil.

Contractors measured plutonium at levels up to 47 picocuries in ditches outside the plant and 500 picocuries on plant grounds.

Those measurements were made after the first evidence of environmental problems outside the plant surfaced in 1988, when a county health inspector found technetium and chemical carcinogens from the plant in a farmer's well. The discovery of the poisoned wells prompted a multimillion-dollar ground-water cleanup under the Environmental Protection Agency's oversight.

Although plant managers posted creeks and ditches with warning signs in the early 1990s, the signs do not refer to plutonium or any other radioactive contaminants. Some warn of possible contamination with cancer-causing chemicals; others merely caution against eating local fish.

## Lawsuit Alleges

### Deliberate Dumping

In addition to the substances that flowed or spilled out of the plant through the drainage ditches, the employees contend in their lawsuit that a wide variety of contaminated substances were deliberately dumped into the environment. Spilled black powder and empty radioactive waste containers allegedly were placed in dumpsters and trucked to a sanitary landfill on DOE property licensed only for trash and garbage. Rubble from demolished buildings and contaminated railroad ties allegedly were dumped in nearby woods and fields. Slag from uranium smelters was put in abandoned concrete bunkers in a state wildlife area outside the plant, according to the lawsuit.

"There was only one dumpster for all waste, whether radioactive, hazardous, toxic or ordinary," Jenkins said.

Plant records describe at least two dozen unlicensed radioactive debris piles on state lands outside the plant. Last year, ground-water tests turned up technetium directly beneath the sanitary landfill.

In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant The Washington Post August 8, 1999, Sunday, Final Edition

A 1990 DOE audit of **Paducah** found inadequate controls over waste disposal and a faulty system for tracking contamination that forced managers to rely on "word of mouth."

Charles Deuschle, 56, a health physics technician and the third employee in the lawsuit, said he was "shocked" when his surveys discovered radioactive contamination in such places as the plant's cafeteria.

"I saw conditions that would never have been tolerated in any other nuclear location where I have worked," Deuschle, who came to **Paducah** in 1992, said in court documents.

Internal plant surveys included in the suit found high levels of radiation on street surfaces, manhole covers and loading docks and in locker rooms as recently as 1996.

The plant's current managers maintain that all significantly contaminated areas have been addressed. "Hot" surfaces have been coated with absorbent paint, and warning signs have been posted, they said. Rope fences keep passersby away from radioactive equipment rusting in the open. Drain pipes and fire hydrants are coated with warning paint. Two dilapidated buildings where the black powder was once processed are padlocked. In 1997, regulatory oversight of the plant was transferred to the Nuclear Regulatory Commission, which declined to comment on allegations in the sealed lawsuit.

Even the employees involved in the suit concede that safeguards have improved recently. But they insist that problems remain. This spring, elevated radioactivity was found in a parking area near the administration building, plant documents show.

Soil collected from a ditch outside the plant's fence by The Post in June and analyzed at a commercial lab contained 2.6 picocuries of plutonium, slightly higher than the NRC's suggested guideline for cleaning up nuclear sites.

The Post, using two hand-held detectors, also found sharply elevated radiation levels in the debris piles on the state wildlife lands. One such area was an unmarked pile of rotting railroad timbers near fishing ponds and campgrounds.

Public Reports Tell

Only Part of the Story

Environmentalists, plant workers and neighbors claim that plant officials play down the hazards.

"They cloak it in jargon," said Mark Donham, a member of a citizens advisory board that meets monthly with plant cleanup officials. "You have to order the documents and then spend hours and hours looking at them to learn anything."

DOE officials say the facts and figures about the plutonium contamination inside the plant have been duly recorded since 1991 in thick inspection reports. But these are kept in archives rarely visited by the public.

In the annual environmental reports that circulate to the public, the contamination is described as "trace" amounts of "radionuclides," a catchall term that can include mildly radioactive uranium as well as highly radioactive plutonium.

A 1991 "site investigation" report, done by the plant's contractor and stored in the archives, shows much higher levels of plutonium than the annual environmental reports. The DOE said the reports use different methods and measure different things.

The result has been that the DOE can claim full disclosure about the contamination while plant workers and neighbors remain in the dark, said Owens, the attorney for the plant's neighbors.

"The company has engaged in a cynical disinformation campaign that centered on downplaying risks and presenting confusing and misleading information," he said.

Inside the plant, the first disclosure of plutonium to workers came around 1990 after managers summoned top union leaders to discuss the results of tests ordered after the state found the poisoned wells.

"They took it seriously," a union official, speaking on the condition of anonymity, said of Martin Marietta's presentation. But "the health effects weren't viewed as serious. We just vehemently stressed that the contamination should be cleaned up."

In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant The Washington Post August 8, 1999, Sunday, Final Edition

Plant managers insist that workers today are fully aware of the potential hazards. USEC cites worker training programs that it says include a briefing on plutonium and other radioactive hazards at the plant.

But officials with the union's Washington office contend workers still don't know a fraction of what they were exposed to. "What we're seeing now," said Daniel Guttman, former staff director of the federal Advisory Committee on Human Radiation Experiments, "is the outcropping of the glacier."

Deficient Monitoring

Compounded the Risk

The health effects for **Paducah** workers remain an open question.

The DOE said 442 **Paducah** workers were tested in 1997 and only 8 percent displayed measurable amounts of radiation. It said screening tests since 1992 have found no evidence of plutonium exposure in workers.

But the greatest exposure to workers would have occurred before the enhanced monitoring that began in the late 1980s.

In 1990, the DOE audited safety practices at **Paducah** and found scores of deficiencies in radiation monitoring and worker protection. The audit team said **Paducah** failed to properly monitor radiation to workers' internal organs -- even though plant managers had been repeatedly warned to do so.

Radiation-measuring equipment was either missing or not properly calibrated, the report said, and workers weren't being tested for the kinds of radiation known to exist at **Paducah**. Whether the plant's equipment and personnel were even capable of detecting exposure to plutonium and other transuranics was "questionable," the audit said.

Bolstering claims by workers that they had been left in the dark about radioactive hazards, the report found no mention of transuranics in plant safety procedures.

"Onsite environmental radiological contamination conditions are largely unknown," the report said. "A formal program with well-defined monitoring, sampling and analysis requirements does not exist."

Independent experts are investigating **Paducah** as part of two national studies of environmental and safety issues in the U.S. nuclear weapons complex. Both studies are relying primarily on data supplied by the plant. Officials brought in two years ago to review past radiation hazards told The Post they were not informed that **Paducah** workers may have been exposed to significant amounts of plutonium.

Neither was Harold Hargan, a plant worker for 37 years. Hargan was one of about six workers who he says were told in 1990 that a test had found plutonium in their urine.

"It surprised me. Hell, it surprised the doctor," Hargan said. "Everybody knew there was no plutonium at **Paducah**."

What Happened Inside the Plant

Uranium is a naturally radioactive element that comes mainly in two forms, or isotopes: uranium-238 and a small amount of uranium-235. Only U-235 is fissile, or capable of being split in a nuclear chain reaction. To make bombs or nuclear fuel, uranium must be "enriched" by increasing the proportion of U-235.

The Mission: Uranium Enrichment

1. Uranium ore from mines is milled in a process to extract uranium oxide, known as yellowcake. The yellowcake is sent to **Paducah**.
2. At the **Paducah** plant, yellowcake is burned with hydrogen to form uranium dioxide, a black powdery substance called "black oxide."
3. The black oxide is mixed with hydrofluoric acid to make uranium tetrafluoride, known as greensalt.
4. The greensalt is burned with fluorine to make uranium hexafluoride

Since the late 1970s, **Paducah** has purchased uranium hexafluoride from other companies. Today, the enrichment process begins here.

In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant The Washington Post August 8, 1999, Sunday, Final Edition

5. Finally comes the gaseous diffusion process for which the plant is named: The liquid uranium hexafluoride is heated and passed through a series of barriers, which separate and concentrate the U-235 isotope. The low-enriched uranium is condensed to a solid and packed into drums for shipping.

The enriched uranium is shipped to another plant for further enrichment to make commercial nuclear fuel. In the past, some was converted to highly enriched uranium for bombs.

4%-5%U235 Nuclear fuel for power plants

90%U235 Nuclear weapons

Enormous amounts of uranium are left over after enrichment.

The processes used at **Paducah** also can move backward, turning uranium hexafluoride back into greensalt, or into depleted uranium metal for use in armor-piercing munitions or armor plating.

Uranium hexafluoride mixed with magnesium yields greensalt, uranium metal and slag.

#### Contamination Spreads

Beginning about 1953, uranium from spent nuclear fuel was sent to **Paducah** to be enriched. Each shipment contained small amounts of plutonium and other radioactive contaminants.

#### Worker exposure

Processing uranium generated large amounts of contaminated airborne dust inside the buildings. Also, radioactive material often was spilled, then swept up by hand, hosed into gutters or placed in regular trash receptacles, whistle-blowers say.

Workers carried uranium home on their skin and clothes.

#### Metals Recovery

Old nuclear warheads were dismantled at **Paducah**, where the radioactive material was extracted and gold and other precious metals were recovered.

The recovered gold was melted into bars. Whistle-blowers allege some was shipped away without being measured for radiation.

Tens of thousands of drums used to ship uranium are stored outdoors at the plant. Many drums still contain radioactive material.

This "depleted" uranium -- still radioactive -- is stored in tens of thousands of cylinders in open lots.

The plant continues to store significant amounts of various recovered metals deemed too contaminated to ship.

The concrete-like gray slag, a contaminated

byproduct of the process, allegedly was trucked to sanitary landfills and dumped in public areas near the plant. Large amounts of contaminated slag remain on the site.

#### Hazards Inside the Plant

For decades, plutonium and other radioactive hazards quietly spread through this Kentucky uranium plant, exposing unsuspecting workers to an invisible and potentially lethal threat. Red areas on this diagram denote contamination that was detected around the main work areas in 1992.

'Barrel Mountain': A nearly half-mile mound of large piles of rusted metal scrap and other waste materials, some of it contaminated.

Classified burial ground: This landfill contains nuclear weapons components. Workers who dismantled weapons may have been exposed to beryllium, a highly toxic metal.

Burial pits: Enormous amounts of radioactive material lie in shallow landfills on plant grounds, and some are believed to be leaching into ground water. One pit contains hundreds of barrels of a highly flammable form of uranium stored in PCB-tainted oils.

In Harm's Way, And in the Dark; Workers Exposed to Plutonium at U.S. Plant The Washington Post August 8, 1999, Sunday, Final Edition

**Waste-water discharges:** Company documents acknowledge the release of tens of thousands of pounds of uranium into creeks. Toxic chemicals and metals also were discharged in waste water.

**Dirty runoff:** Rain washes uranium and other hazards into ditches that flow past outdoor scrap yards. Some of the ditches are posted as radioactive inside the plant fence, while just outside the fence there are no such warnings.

**Fouled ditches:** Uranium, plutonium and other radioactive materials were flushed into ditches, such as this one, that flow into tributaries of the Ohio River. A test commissioned last month by The Washington Post found plutonium here. Earlier tests of the ditch inside plant grounds found plutonium at a level 100 times above what the government certifies as safe.

**One of the most contaminated buildings still in use,** C-400 contained chemical solvent tanks for cleaning radioactive equipment. Workers this year found an old canister that contained radioactive technetium at levels millions of times above the safety standard.

**Outdoor hazards:** Plant officials recently discovered radioactive contamination in this gravel parking lot near the main administration building. Dozens of "hot spots" around the plant grounds mark the sites of old spills or dumps.

**Buildings 410 and 420:** Hundreds of workers were exposed to radioactive dust in these buildings, which were used to process uranium before enrichment.

**Contaminated buildings:** Elevated radiation levels have been found in hundreds of areas frequented by workers, including a cafeteria.

**Tainted wells:** Two large plumes of contaminated ground water extend more than a mile north of the plant into residential neighborhoods. The water is contaminated with chemical and radiological wastes.

**Cylinder piles:** More than 30,000 metal tanks containing a toxic mix of depleted uranium and fluorine are stacked in open lots. Until recently, some were stored in a nearby residential neighborhood.

**Process buildings:** The heart of the plant, these stadium-sized buildings now enrich uranium for commercial nuclear fuel. The truck alleys along the sides of each building are contaminated from spills during deliveries.

**Chemical spills:** Thousands of gallons of toxic chemicals -- including suspected carcinogens -- were released into the environment in a series of leaks and spills. Some ended up in nearby creeks.

**Airborne releases:** Exhaust fans vented radioactive dust into the atmosphere. Workers say the biggest releases were always at night.

**Switchyards:** The plant requires enormous amounts of electricity -- two generating plants are dedicated to its needs. As recently as 1996, the plant also was the nation's largest single emitter of freon, the coolant blamed for damaging the Earth's ozone layer.

**SOURCES:** "Radiological Survey of Selected Outdoor Areas, Paducah Gaseous Diffusion Plant, Paducah, Kentucky," prepared by Oak Ridge Associated Universities, April 1992; Washington Post research. Satellite photo from U.S. Geological Survey.

#### Spreading Toxins

Radioactively contaminated slag and rubble from demolished buildings was dumped outdoors in more than two dozen places around the plant. For decades, waste water containing uranium, plutonium and cancer-causing chemicals was discharged into ditches and creeks that flow into the Ohio River, three miles away.

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The Washington Post

August 9, 1999, Monday, Final Edition

## Richardson Orders Probe Of Uranium Plant in Ky.

**Joby** Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A01

**LENGTH:** 893 words

Energy Secretary Bill Richardson ordered an immediate investigation yesterday into reports that thousands of unsuspecting employees at a Kentucky uranium plant were exposed on the job to cancer-causing plutonium.

Richardson said he would meet with workers at the **Paducah** Gaseous Diffusion Plant and would request a National Academy of Sciences study to probe the links between worker illnesses and exposure to radioactive materials that occurred over decades at the federally owned plant.

He also called for expanding a newly created program to bring health screening and medical treatment to thousands of workers who may have been put in harm's way at **Paducah** and similar facilities that were part of the government's nuclear weapons complex.

"I have long maintained that we must correct the sins of the past by compensating workers who have been medically damaged," Richardson said in an interview. "I don't want this to be known as the department of excuses for not dealing with workers who have been harmed."

His remarks came after The Washington Post reported that workers at the **Paducah** plant had been unwittingly exposed to plutonium and other radioactive metals that entered the plant over decades in shipments of used uranium from military nuclear reactor fuel. The report was based in part on sealed court documents filed as part of a lawsuit by workers and an environmental group, the Natural Resources Defense Council. The suit alleges that government contractors concealed evidence of the exposure for decades while allowing plutonium and other hazards to spread into the environment.

The workers also allege that former plant managers allowed contaminated waste to be dumped into a state-owned wildlife area and a landfill not licensed for hazardous waste. They further contend that radioactively contaminated gold and other valuable metals may have been shipped out of the plant without being properly tested.

Thomas Cochran, a nuclear expert with the NRDC who reviewed conditions at the plant, said health and safety practices there were the worst "outside the former Soviet Union." Former plant operators had not been served with the suit and declined to comment. The whistleblowers and their Washington attorney, Joseph Egan, said they also could not comment because of the judge's seal on the case.

Energy officials sent a team to **Paducah** for an initial probe after the documents were first filed in June, Richardson confirmed. "They did not uncover any imminent threats . . . but we are continuing to investigate these concerns," Richardson said.

The expanded investigation he announced yesterday would seek to uncover "what actually occurred, who was responsible and what must be done to assure that it never happens again," he said.

Among the specific measures:



Top Energy Department officials will be dispatched to **Paducah** this week to check compliance with environmental and safety regulations. The agency's Office of General Counsel will assess whether former contractors, including Lockheed Martin Corp. or Union Carbide Corp., had fulfilled their responsibilities to protect workers and the environment.

Besides the health study by the National Academy of Sciences' Institute of Medicine, the Energy Department will institute a medical surveillance and screening program for employees. A screening of former **Paducah** workers is just beginning as part of the Former Worker Program, a congressionally ordered study of past exposures of employees in the U.S. nuclear complex.

The department's fiscal 2000 budget request will be reassessed and revised as necessary to include money to probe and rectify environmental and health concerns at the government's uranium enrichment plants.

Richardson will ask the White House to expand a newly created program to provide millions of dollars in medical screening and other benefits to Energy Department workers who were exposed to beryllium, a highly toxic metal used in nuclear weapons. "These actions are warranted given the concerns raised . . . and I will not rest until these issues are fully dealt with and any injured workers are fairly compensated," Richardson said.

**Paducah** workers were exposed to plutonium through shipments of contaminated uranium that arrived at the plant from 1953 to 1976, a period when national security priorities often surmounted concerns over risks to workers and the environment. The plutonium shipments stopped, but contaminants remain spattered over hundreds of acres of buildings and grounds. Workers did not learn of the problems until at least 1990, and some contend they were never told.

The U.S. Enrichment Corp., a government-chartered private corporation that took over management of the plant this year, contends that all significantly contaminated areas have been cleaned up or marked with warning signs.

Although no comprehensive study of worker medical histories has been conducted, current and former workers at the plant have linked past exposures to a string of cancers and other diseases.

Richardson said although many of the exposures at **Paducah** were historical, the government bears responsibilities for those who may have been injured.

"Even though it was the 1950s and everyone was gung-ho," he said, "it doesn't mean that you can forget about workers who have been made sick."

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The Washington Post

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## **A Deathly Postscript Comes Back to Life; After Being Rejected, Warnings of **Paducah** Atomic Worker Now Hailed as Heroism**

**Joby** Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A01

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A Deathly Postscript Comes Back to Life; After Being Rejected, Warnings of Paducah Atomic Worker Now Hailed as Heroism The Washington Post August 11, 1999, Wednesday, Final Edition

**DATELINE: PADUCAH, Ky.**

Stricken with cancer, his body mottled with painful sores, uranium worker Joe Harding picked up a pen for a final postscript to his nine-year struggle against the U.S.-owned factory he blamed for his fatal illness. "It is absolutely futile," he wrote just before his 1980 death, "like fighting a tiger with a toothpick."

Two decades later, Harding is being proclaimed a "Cold War hero" by the same government that brushed aside his claims of dangerous radiation inside the **Paducah** Gaseous Diffusion Plant in western Kentucky.

Revelations this week of worker exposure to plutonium at the **Paducah** plant have rekindled interest in the Harding case, which was championed briefly by anti-nuclear groups in the early 1980s as an example of the human cost of building America's nuclear arsenal. Although experts at the time linked Harding's ailments to radiation, the Department of Energy in 1981 dismissed Harding's reports of dangerous working conditions and declared the plant to be safe. Harding's disability pension and medical insurance were dropped and he was left nearly penniless.

Energy Secretary Bill Richardson, who has launched a probe into worker exposures at **Paducah**, said yesterday the government owed Harding and other workers a thorough investigation into whether their service in the nation's nuclear weapons complex had placed them in harm's way.

"Joe Harding was a hero of the Cold War," Richardson said in statement to The Post. "But in the past, I believe that the government basically said -- without any review -- that there is no established linkage between the exposure these workers had and their illness. The Clinton administration is saying that's not our policy. We're going to make sure these workers are taken care of."

The renewed interest in Harding came amid a flurry of calls for an expanded probe into environmental and safety problems at the plant. Sen. Mitch McConnell (R-Ky.) Monday demanded a congressional hearing into reports that contaminated material was dumped outside the plant. Kentucky Gov. Paul E. Patton (D) has appointed a state task force to examine claims of environmental damage. And Rep. Ted Strickland (D-Ohio) has asked the Department of Energy to account for contaminated uranium from **Paducah** that was shipped to a sister plant in Portsmouth, Ohio.

David Michaels, the department's assistant secretary of environment, safety and health, told workers at **Paducah** the agency had let them down in failing to inform them about contaminants in the workplace. "There's been a real communications problem here," he told a news conference Monday.

The Washington Post reported on Sunday that plutonium and other highly radioactive metals slipped into the plant over 23 years in shipments of recycled uranium from U.S. plutonium production factories.

Sealed documents filed as part of a lawsuit against the plant's former operators allege that workers were exposed to plutonium-laced dust through the 1970s in the hot, smoky buildings where uranium was turned into fuel for bombs and nuclear power plants.

One of those workers was Joe Harding, whose case has emerged as a powerful symbol of environmental and bureaucratic ills that allegedly plagued the facility. Although no comprehensive medical studies have been done of the health effects on plant workers, union officials and others have been tracking cases of cancer at the plant. Harding himself kept a list of more than 50 cancers among 200 people who began working with him at the plant in the early 1950s.

Richardson has ordered a comprehensive medical review of current workers and an investigation of links between radiation exposures and illnesses.

Union officials said yesterday the government not only failed to protect Harding, but also fought vigorously to prevent the worker and his widow from receiving a pension or medical insurance.

"The DOE took the Joe Harding case very seriously: No dollar was spared in seeking to deny his claims," said Richard Miller, a policy analyst for the Paper, Allied-Industrial, Chemical & Energy Workers International Union,

A Deathly Postscript Comes Back to Life; After Being Rejected, Warnings of Paducah Atomic Worker Now Hailed as Heroism The Washington Post August 11, 1999, Wednesday, Final Edition

which represents workers at the plant. "No effort was spared in their scorched-earth campaign to deny what was overwhelmingly obvious."

In the months before succumbing to cancer at age 58, Harding meticulously documented environmental problems at the plant in tape recordings and in letters and journal entries obtained by The Post.

It was "important, patriotic, secret work," Harding wrote of the job he started in 1952, the year the plant opened. "Brainwashing started in training school: 'Don't talk to anyone. Never mention radiation. The public is stupid about radiation.' "

Soon Harding was put to work as a "process operator," mixing powdered uranium with fluorine and other chemicals. Inside the buildings, he wrote, the air was "heavy" with uranium dust, which is mildly radioactive and toxic if ingested or inhaled. Unknown to workers at the time, it also contained small amounts of plutonium and other radioactive metals that are thousands of times more dangerous than uranium.

"I spent all those years breathing uranium hexafluoride gas so thick and heavy that you could see the haze in the air," Harding said in a hand-written account in 1979. "You could taste it coated on your teeth and in your throat and lungs. . . . Powder on the floor was thick enough that you would leave tracks."

If workers worried about radioactive exposure from the dust, their concerns were brushed aside, Harding said. He said the official line from supervisors was: "You will not get any more radiation in this work than you would get from wearing a luminous dial wristwatch."

Harding had worked at the plant less than a year when the first medical symptoms appeared, according to records made available by his widow. Lesions appeared on his legs, and slowly spread through the rest of his body. His weight dropped from 175 to 125 pounds. Searing pain radiated from his stomach and he vomited so frequently his co-workers mockingly called him "Joe Erp."

Later, fingernail-like calcium growths began emerging from his finger joints, elbows and knees. X-rays of his lungs turned up odd-looking pockmarks. He lost most of his stomach to cancer.

Physicians were mystified by Harding's ailments, though privately, he recalled, some suggested a possible cause: Radiation exposure. Harding didn't believe it.

"Radiation? Hell, no!" he remembered saying. Later, though, as the symptoms worsened, Harding began to doubt assurances by Union Carbide, the plant operator, about safety. He remembered feeling nervous about maintenance jobs that required him to crawl inside large pipes used to carry radioactive uranium gas between buildings.

"Pitch dark, full of UF<sub>6</sub> [uranium hexafluoride] smoke and powder," he said of the pipes. "Felt like saying 'Goodbye, world,' on entering."

Eventually Harding's increasingly vocal complaints about working conditions earned him a reputation as a troublemaker, and he bounced around from one section of the plant to another. Finally, in 1971, the plant offered him a full-disability pension, citing a leg injury that Harding had received on the job.

Harding accepted the offer and went home to wait for his first check. It never came. He later learned that his disability claim had been rejected, and along with it his pension and medical insurance.

"This left me 50 years old with no job, and a crippled leg to get worse," he wrote. "No stomach. Bad lungs. No way to get a job, no way to make a living."

Months after his death from stomach cancer in 1980, Harding's medical records were reviewed by Karl Z. Morgan, an internationally known radiation expert who concluded Harding's health problems were "strongly suggestive" of radiation exposure from chronic inhalation of uranium dust. Later, Harding's body was exhumed for testing, and uranium was found in his bones.

Meanwhile, Energy Department officials were conducting their own investigation, at Harding's request. After 18 months and a two-day visit to **Paducah**, the department concluded that Harding's illnesses were more likely caused by smoking and by the fact he "frequently ate country ham," according to the 1981 report. Based on computer modeling, the report's writers said the radiation exposures at **Paducah** were not sufficient to cause illnesses.

A Deathly Postscript Comes Back to Life; After Being Rejected, Warnings of Paducah Atomic Worker Now Hailed as Heroism The Washington Post August 11, 1999, Wednesday, Final Edition

"The presence of thick dust in the air which Mr. Harding stated occurred . . . is not consistent with the mode of operation," the report said.

The department's findings are now contradicted in court documents and interviews with current and former workers who also describe high exposures to uranium dust in the plant. Workers say the dust clung to their hair and skin and even contaminated the food they ate.

Whether the new evidence from whistleblowers will ultimately vindicate Harding is unclear. If it does, it will provide little consolation for his widow, Clara, who lost both a husband and the financial security that was supposed to see her into twilight years.

Clara Harding sold her house and moved to a small duplex on the outskirts of town. She continued to fight for the pension in court for several years before finally settling the case for \$ 12,000.

For her, the battle was clearly over from the first hearing, when Harding and her lawyer arrived in court to find a phalanx of attorneys and experts from the plant and the Energy Department representing the other side.

"There were 14 of them and only two of us," she remembered. "So that was pretty much that."

**NAME:** JOE HARDING

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The Washington Post

**August** 22, 1999, Sunday, Final Edition

## **Paducah's Silent Witness; Excessive Uranium Level Found in Worker's Bones**

**Joby** Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A01

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The exhumed bones of a long-dead uranium worker have given a powerful boost to current employees' claims of dangerous exposures inside a government-owned Kentucky plant that supplied radioactive fuel for the nation's nuclear bombs.

The long-overlooked medical evidence from the case of Joseph Harding suggests that for some workers radiation doses at the **Paducah** Gaseous Diffusion Plant were far higher than previously believed, and may have been dozens of times above federal limits, according to one analysis of the data.

The hazards for uranium workers are further underscored by unpublished research from a sister plant in Tennessee. A draft study of workers at the K-25 plant in Oak Ridge shows unusually high death rates for former uranium workers, as well as sharply higher rates of lung and bone cancers.

Paducah's Silent Witness; Excessive Uranium Level Found in Worker's Bones The Washington Post August 22, 1999, Sunday, Final Edition

The results of Harding's posthumous tests, conducted as part of a lawsuit in 1983 but never published, offer the strongest corroboration to date of hazardous conditions inside the **Paducah** plant, where workers labored for decades in a haze of radioactive dust that was sometimes laced with deadly plutonium.

"Uranium content of the bone was far in excess of normal expectations," wrote Alice Stewart, an internationally known British researcher who reviewed the results of laboratory tests of Harding's remains for his estate. "The terminal finding overrules all earlier impressions [from U.S. government officials] of NO internal depositions of uranium."

Lab technicians were unaware of the presence of plutonium at the plant and did not test for it. Plutonium is about 100,000 times more radioactive per gram than uranium and can cause cancer if inhaled in microscopic amounts. Workers only recently learned that plutonium and other highly radioactive metals entered the plant in contaminated uranium shipments from the early 1950s to the mid-1970s.

The Department of Energy has launched an extensive investigation into claims of worker exposures at the **Paducah** plant as well as the K-25 plant and a third facility in Ohio. While the department had not evaluated the results of Harding's bone tests as of last week, agency officials said it is now clear that uranium workers were not properly protected until at least 1990, when new safety guidelines were implemented.

"This reaffirms our decision to get out of the business of fighting sick workers," David Michaels, assistant secretary for environment, safety and health, said in an interview Friday. "This case is an example of how the DOE placed mission and secrecy in a paramount position in the past. Right now, we should be bending over backward to help those workers who helped win the Cold War for us."

Both the **Paducah** and K-25 plants were owned by the federal government and operated by the same group of corporate contractors: Union Carbide from the 1950s to the early 1980s, followed by Martin Marietta and Lockheed Martin Corp.

The latter two are the targets of a lawsuit filed by a group of current employees who allege unsafe working conditions and environmental contamination. Former workers also have alleged that radiation monitoring equipment at the **Paducah** plant was defective; in some cases, they say, "film" badges used to monitor exposures contained no film.

"The dose evidence corroborates our allegations that the health physics program at **Paducah** has been essentially nonexistent," said Thomas Cochran, nuclear program director at the Natural Resources Defense Council, which joined workers in the lawsuit. "The contractors have been operating in callous disregard for the health and safety of the work force."

Harding, an 18-year veteran plant worker who died of cancer in 1980, was hailed last week by Energy Secretary Bill Richardson as a "hero of the Cold War." But for the nine years before his death his claims of radiation exposure were vigorously challenged by contractors and Energy Department officials, who said conditions in the plant were safe.

The department disputed Harding's allegations -- verified years later by other workers -- of a dense fog of uranium dust and smoke that would cling to workers' skin and coat their throats and teeth. A department study in 1981 attributed Harding's death to a combination of smoking and eating country ham.

Eventually Harding developed stomach cancer along with an array of unusual maladies that are sometimes linked to radiation exposure, including perforations in his lungs and strange fingernail-like growths on his palms, wrists and shoulders. But after being discharged from the plant in 1971, Harding was denied a disability pension and lost his medical insurance. His widow's efforts to reclaim the pension were opposed by lawyers for Union Carbide and the Energy Department, and she eventually settled her claim for \$ 12,000.

The exhumation of Harding's remains in 1983 was a final attempt by Harding's widow to verify his assertions of exposure to radioactive uranium dust in the plant. His bones were analyzed by a Canadian lab for uranium, but for reasons now unclear the results were never published.

The lab report -- obtained last week by The Post -- not only supported Harding's claims of radiation exposure but also suggested hazards at the plant were far greater than previously believed: More than a dozen years after Harding left the plant, his body contained uranium at levels up to 133 times higher than is normally found in bones.

Paducah's Silent Witness; Excessive Uranium Level Found in Worker's Bones The Washington Post August 22, 1999, Sunday, Final Edition

Moreover, the type of uranium found was "not from natural sources," and apparently came from the plant's uranium enrichment process, the report said.

Because uranium is slowly purged by the body over time, the levels in Harding's bones would have been "several-fold higher" during the time he was employed, the lab report stated.

Exactly how much higher is unclear. But Carl Johnson, a Colorado physician and radiation consultant who analyzed the test results for Harding's widow in 1983, said Harding's uranium "bone burden" in the 1970s would have been between 1,700 and 34,000 times higher than normal. Based on those levels, the annual radiation dose to Harding's bone tissue would have been 30 to 600 rems a year. Under current standards, U.S. nuclear industry workers are allowed a maximum full-body dose of 5 rems a year.

Radiation experts who reviewed the data for The Post said the results could have been skewed by a number of factors, including the possible presence of plutonium in Harding's bone tissue. But by any measure, the exposure was certainly high.

Arjun Makhijani, president of the Institute for Energy and Environmental Research, said conditions at **Paducah** appear to have been similar to an Energy Department site at Fernald, Ohio, where concentrations of radioactive particles in the air are now known to have far exceeded then-allowable limits, in one instance by 97,000 times.

"The DOE and its contractor Union Carbide committed a gross injustice on Joe Harding," Makhijani said. "The DOE is perpetuating that injustice upon the half-million people who worked in the nuclear weapons complex since it has not yet provided the vast majority of the survivors among them with medical monitoring and medical help."

Energy Department officials are now pledging increased medical tests and possibly compensation to thousands of men and women who were exposed to chemical and radiological hazards at **Paducah** and other facilities in the U.S. nuclear weapons complex. The department's investigative team at **Paducah** in coming weeks will attempt to determine exactly what the hazards were, and who was exposed.

The task is fraught with obstacles, including a dearth of monitoring data from the early years when radiation exposures were likely to be highest. Unlike the K-25 plant, no comprehensive study of worker histories has been attempted at **Paducah**.

The draft study of uranium workers at the K-25 plant appears to offer further support for concerns about hazards inside such facilities. The mortality study of about 11,000 former workers at the plant was conducted by the Oak Ridge Institute for Science and Education. Although the research essentially was completed in 1994, funding for the study was dropped before it could be peer reviewed and published in a scientific journal.

The draft report, obtained by The Post, shows higher rates of death for all causes among former workers, a finding that is significant in itself, given that government workers are typically healthier than the general population because of higher salaries and access to health care.

The study also shows higher rates of cancers of the lung (19 percent) and bone (82 percent) among white male workers compared with the general population. Both cancers are sometimes linked to radiation exposure.

Researchers point to several factors that could have skewed the results, including the inclusion in the survey of a sample of thousands of people who worked at the K-25 plant for a relatively brief period during World War II.

Since many able-bodied men were in the military during that period, the remaining work force may have been less healthy than the general population, the authors said.

A new study is underway to track death rates among K-25 workers who were exposed to the highest amounts of radiation. Similar mortality studies at the Portsmouth Gaseous Diffusion Plant in Ohio have shown relatively low rates of cancer.

Another possible problem in evaluating risks for **Paducah** workers is the reliability of the data. Previous Energy Department audits of the plant's safety records cited extensive problems with monitoring programs and equipment. And former and current workers at the plant say they believe radiation monitoring was shoddy in the past.

Paducah's Silent Witness; Excessive Uranium Level Found in Worker's Bones The Washington Post August 22, 1999, Sunday, Final Edition

Al Puckett, a retired union shop steward who worked at the gaseous diffusion plant in the 1960s and 1970s, said workers would sometimes open their "film" badges only to find no film inside. Suspecting that no one ever examined workers' radiation monitors, Puckett and his colleagues sometimes exposed the badges to radiation by leaving them for hours on top of barrels of enriched uranium.

"We turned the badges in and that was the last we heard of it," he said. "No one ever said anything to us."

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The Washington Post

**September** 16, 1999, Thursday, Final Edition

## U.S. Will Propose Payments to Sick **Paducah** Workers; \$20 Million Fund Eyed For Radiation Cancers

**Joby** Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A01

**LENGTH:** 889 words

The Clinton administration today will propose spending tens of millions of dollars to compensate ailing workers at the government's **Paducah** Gaseous Diffusion Plant in what is described as a step toward acknowledging abuses committed against thousands of men and women who helped build America's nuclear arsenal.

The proposed pilot program, which eventually could be expanded to encompass other Energy Department facilities, will be unveiled by Energy Secretary Bill Richardson during a visit to the plant, department officials confirmed to The Washington Post.

If approved by Congress, the program would compensate current and former employees who have developed specific cancers related to radiation after working at the western Kentucky plant, which has made enriched uranium for nuclear weapons and power plants since 1952. In addition, Richardson will propose \$ 21.8 million in new spending to pay for cleanup and for expanded medical monitoring of workers at **Paducah** and at sister plants in Ohio and Tennessee.

"I'm going to **Paducah** to hear firsthand from the community and workers," Richardson said in an interview.

The visit to **Paducah** comes two days after the release of preliminary findings from a month-long investigation of safety practices at the plant. A team of Energy Department inspectors cited numerous weaknesses in environmental programs and criticized federal managers and cleanup contractors for a "lack of discipline, formality and oversight" in the plant's management of radiation risks.

The team found no evidence of imminent health threats to workers or the public but said radiation controls should be strengthened. In response, Richardson ordered immediate upgrades in safety practices, including enhanced training for workers.

A separate investigation is examining alleged illegal dumping of radioactive waste, as well as claims of worker exposure to harmful levels of plutonium and other radioactive metals before 1990.



U.S. Will Propose Payments to Sick Paducah Workers; \$20 Million Fund Eyed For Radiation Cancers The Washington Post September 16, 1999, Thursday, Final Edition

Energy Department inspectors were due to report additional findings at a House Commerce subcommittee hearing on the **Paducah** plant, scheduled for today but canceled because of Hurricane Floyd's approach toward Washington. The hearing was rescheduled for Wednesday.

Details of the proposed compensation package for **Paducah** workers had not been completed, but Energy Department officials said the cost of the program could exceed \$ 20 million, depending on how many workers qualified.

But the program's initially narrow limits have drawn criticism from the plant's union. The critics noted that workers at other plants were exposed to similar hazards and also deserved to be compensated.

"You've got a worker population at risk, but the administration wants to triage this thing," said Richard Miller, a policy analyst with the Paper, Allied Chemical and Energy Workers International Union who was briefed on details of the plan. "How do you justify compensating workers at one plant, while saying another plant across the river doesn't merit the same compensation?"

Limits on compensation for exposed workers have been the subject of debate in the administration for weeks. Earlier in the summer, the Energy Department announced plans to separately compensate workers who had been exposed to beryllium, a highly toxic metal that was widely used in making nuclear weapons components. The White House also has launched an interagency review that will look at a wide range of workplace hazards at Energy Department plants, especially uranium plants in Piketon, Ohio, and Oak Ridge, Tenn.

Richardson ordered the probe at the **Paducah** plant on Aug. 8 after a Washington Post investigation highlighted radioactive contamination at the plant, including worker exposure to plutonium. Documents filed in a worker lawsuit accuse the plant's former operators of failing to protect workers from -- or even to warn them of -- radioactive hazards.

The **Paducah** plant is owned by the Energy Department but has been managed by a series of corporate contractors. In May, management of uranium processing passed to U.S. Enrichment Corp., a government-chartered private company that is regulated by the Nuclear Regulatory Commission. The Energy Department's investigation at **Paducah** has focused mainly on policies and practices of department managers, as well as separate government contractors charged with cleaning up contamination.

The \$ 21.8 million that Richardson will announce includes \$ 7 million for environmental health programs to analyze past safety risks and current health hazards. The information will be provided to the National Academy of Sciences' Institute of Medicine to help determine compensation for worker illnesses.

Yesterday, an Ohio newspaper reported that workers at the **Paducah** facility's sister plant in Piketon also handled a greater amount of the type of plutonium-laced uranium oxide that caused widespread problems in **Paducah** than was previously acknowledged.

Like the **Paducah** facility, the Portsmouth Gaseous Diffusion Plant in Ohio received shipments of contaminated recycled uranium directly from nuclear power plants, the Columbus Dispatch quoted Energy Department officials as saying. The uranium contained small amounts of plutonium and other radioactive material normally not present at gaseous diffusion plants.

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**September** 21, 1999, Tuesday, Final Edition

## Radiation Risks Long Concealed; Paducah Plant Memos Show Fear Of Public Outcry

Joby Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A01

**LENGTH:** 1396 words

Managers of the government's Paducah, Ky., uranium plant knew for decades of unusual radiation hazards inside the complex but failed to warn workers because of fears of a public outcry, according to documents to be released by a congressional panel this week.

Faded memos unearthed by workers and federal investigators shed new light on what early plant officials knew about the presence of plutonium and other highly radioactive metals in the plant -- knowledge that was kept from the workers for nearly four decades.

In one 1960 document, a government physician wrote that hundreds of workers should be screened for exposure to "transuranics" -- radioactive metals such as plutonium and neptunium -- but he said plant officials feared such a move would cause alarm and lead to higher labor costs.

"They hesitate to proceed to intensive studies because of the union's use of this for hazard pay," says the memo, discovered by Energy Department officials investigating the plant.

The documents from government archives have been turned over to a House Commerce Committee panel, which is holding hearings Wednesday into allegations of unsafe conditions at the Paducah Gaseous Diffusion Plant. The Washington Post obtained advance copies of the documents and prepared testimony of some current and former plant officials.

Accounts of plutonium contamination and illegal waste dumping at the facility have triggered an Energy Department investigation and a class action suit by employees who believe the plant put them at risk.

Energy Secretary Bill Richardson toured the plant on Friday and formally apologized to workers for the government's failure to fully inform them about the risks. He pledged millions of dollars in new spending to compensate ailing workers and to accelerate the cleanup of the plant. And he presented an award to the family of the late Joe Harding, an employee who had tried vainly for years to convince Energy officials that hazards in the plant had caused his fatal illness.

"On behalf of the government I'm here to say I'm sorry," Richardson said. "The men and women who have worked in this facility helped the United States win the Cold War and now help us keep the peace. We recognize and won't forget our obligation to them."

Plant officials, while acknowledging the presence of plutonium at Paducah, have said the amounts were small and were likely of little threat to workers.

Government contractors who ran the plant over the last 47 years have declined to comment because of pending litigation. A Union Carbide Corp. spokesman, in a statement last month, said the alleged acts at Paducah occurred long ago, and none of the current managers had any detailed knowledge of what had happened. Union Carbide operated the plant from 1952 to 1983.

The documents and testimony to be presented at the congressional hearing suggest that the federal government and private contractors running the plant ignored decades of warnings to protect workers from plutonium, a man-made metal that can cause cancer if inhaled in amounts as small as a millionth of an ounce.

"What is clear is that the [government] contractors knew of the need to protect workers from plutonium and other transuranics . . . as early as 1952," Jim H. Key, the ranking environmental and safety official for the plant's unionized employees, states in prepared testimony to be delivered Wednesday.



Radiation Risks Long Concealed; Paducah Plant Memos Show Fear Of Public Outcry The Washington Post  
September 21, 1999, Tuesday, Final Edition

Key, who has not yet spoken publicly about the allegations of workers' exposure, alleges "widespread, systematic and documented failures" by the government and its contractors to control the spread of radioactive hazards. He describes smoky, radioactive fires inside the plant and thick clouds of radioactive uranium dust -- workplace hazards for which workers were neither trained nor equipped.

Former workers also have come forward with evidence suggesting that past managers viewed the contamination as a practical and economic problem. John Tillson, a hydrologist who analyzed early operations at the plant while working for a cleanup contractor, said **Paducah** managers tried to recover the transuranics from the plant's waste stream in the 1950s and 1960s, when the metals were in high demand for nuclear materials research.

By 1970 the prices had dropped, and the recovery programs were halted, he said.

Plant officials even began processing sewage sludge from the plant after it was found to contain high levels of uranium. Harold Hargan, a 37-year employee who was detailed to the recovery program, said the uranium in sludge came exclusively from the plant's sanitary system, which included lavatories, wash rooms and laundry facilities. "All that uranium was either on workers' clothes or bodies -- or inside their bodies," he said.

Although no formal epidemiological study has been completed for **Paducah**, some workers have long raised questions about what they believe are unusual rates and types of cancers in their communities. Those fears have risen sharply in the wake of reports that plutonium and other highly radioactive metals were also present in the workplace, Key, the union safety officer, says in his statement.

"The majority of current and former workers are afraid that they may have been exposed to substances like plutonium without proper protection and that they will, as a result, be stricken with a fatal disease," Key wrote. "I myself have this fear from my 25 years at **Paducah**."

Hired by the plant's original contractor, Union Carbide, in 1974, Key said he began witnessing safety problems almost immediately. During his first year on the job, he was engulfed in radioactive smoke after helping dump drumloads of highly flammable uranium metal into an open pit on the plant's grounds.

"The uranium spontaneously ignited . . . and a pungent and irritating smoke enveloped us," said Key, an hourly worker and officer in the local chapter of the Paper, Allied-Industrial, Chemical and Energy Workers International Union. "To my knowledge this dumping ground has never been characterized."

Workers inside the building where powdered uranium was processed were not required to wear respirators, even though the dust at times was so thick it was difficult to see, Key said.

"I recall having to hold my breath to get through clouds of unknown fumes," he said.

In the 1970s, Key would observe workers cleaning up spills of "black powder," which he later learned consisted of recycled uranium from the government's plutonium production facilities. Not until 1990 did plant officials tell the union that the powder contained small amounts of "transuranics" -- a class of highly radioactive metals that includes neptunium and plutonium. Plutonium is 100,000 times more radioactive per gram than uranium.

Key cited a 1952 Union Carbide memo that suggests the need for special labeling of "plutonium contaminated locations."

Years later, in a 1985 memo, Energy officials advised **Paducah's** managers to test workers who handled the recycled uranium for exposure to transuranics. Key notes, "We have no evidence that these recommendations were acted upon or communicated to the workforce."

In 1991, Martin Marietta Energy Systems, which was now operating the plant, began a voluntary program to test workers for exposure. Thirty workers participated, but the test results were "invalidated" due to what the company termed "concerns and discrepancies" regarding the testing lab, Key said.

He said the company refused to release the results to the union, explaining in a memo that "management is reluctant to release this information due to concerns about how it would be used."

Concerns about public reaction were echoed in the 1960 memo from H.D. Bruner, a physician, to Union Carbide and Atomic Energy Commission medical officials. He expressed concerns about relatively large

Radiation Risks Long Concealed; Paducah Plant Memos Show Fear Of Public Outcry The Washington Post  
September 21, 1999, Tuesday, Final Edition

amounts of neptunium in recycled uranium delivered to the **Paducah** plant. "But I am afraid the policy of the plant is to be wary of the unions and any unfavorable public relations," the memo states.

Although workers in some buildings were furnished with gas masks, Bruner said the respirators were not used and did not appear to be effective against the tiny uranium particles in the air.

"The human factor in handling [the recycled material] should be considered a source of potential exposure," he wrote.

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The Washington Post

**October** 21, 1999, Thursday, Final Edition

## Energy Dept. Faults **Paducah** Contractors; Deficient Plant Hazard Warnings Cited

**Joby** Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A02

**LENGTH:** 540 words

The Energy Department, ending the first phase of its investigation of the troubled **Paducah**, Ky., uranium plant, faulted contractors yesterday for failing to properly warn the public about radioactive hazards, including "relatively high" levels of plutonium in ditches outside the plant.

Investigators zeroing in on the plant's current environmental and safety problems also pointed to the "theoretical" risk of an accidental nuclear chain reaction at the plant, citing large quantities of "uncharacterized" radioactive material stored there.

The problems were among dozens uncovered in the first of two department probes of current and past hazards at the **Paducah** Gaseous Diffusion Plant, one of two U.S.-owned facilities that produce enriched uranium. Yesterday's report gives the plant's managers 30 days to come up with a plan for addressing problems ranging from lax safeguards to radioactive seepage from a half-mile-long pile of contaminated scrap metal.

"We have concerns about exposure, but we don't think any of them reach the level of imminent danger," said David Michaels, assistant energy secretary for environment, safety and health.

Michaels promised quick action to eliminate any risk of a "criticality"--an inadvertent nuclear reaction similar to last month's serious accident at the Tokaimura uranium plant in Japan. Agency officials said the chances of such a reaction were remote.

Energy Secretary Bill Richardson launched investigations at **Paducah** in August after reports of worker exposure to and sloppy handling of radioactive waste. Preliminary findings released last month faulted the agency and its contractors for weaknesses in identifying and cleaning up contaminants--hazards that included highly radioactive plutonium.

Energy Dept. Faults Paducah Contractors; Deficient Plant Hazard Warnings Cited The Washington Post  
October 21, 1999, Thursday, Final Edition

Yesterday's report contained the first results from independent laboratory tests that confirmed the presence of plutonium and other radioactive metals in ground water as well as in ditches and streams outside the plant fence. The agency's tests found new areas of off-site contamination and also documented "relatively high levels" of plutonium, thorium and cesium in two ditches that feed a tributary of the Ohio River.

The contaminated areas had not been properly controlled or marked with signs, the report said. Plutonium can cause cancer if inhaled in minuscule amounts.

Although plant officials discovered off-site plutonium contamination in the early 1990s, most public reports listed plutonium levels at near zero. The discrepancy has been a sore point with lawmakers who have grilled former contractors as part of their own **Paducah** probe.

Rep. Thomas J. Bliley Jr. (R-Va.), chairman of the House Commerce Committee, expressed dismay yesterday after one former contractor, CH2MHill, insisted in a letter that the plutonium problem was contained within the plant's security boundaries.

"For many years the **Paducah** community has been plagued by misinformation and outright deceit," Bliley said. He vowed to press for "full accountability and the highest level of safety" for **Paducah** workers and residents.

Energy Department investigators pointed to the "theoretical" risk of an accidental nuclear chain reaction at the **Paducah** Gaseous Diffusion Plant.

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The Washington Post

**December** 23, 1999, Thursday, Final Edition

## Plant Hid Risk From Workers; **Paducah** Bosses Knew Some Had High Radiation Levels

**Joby** Warrick, Washington Post Staff Writer

**SECTION:** A SECTION; Pg. A01

**LENGTH:** 2883 words

**DATELINE:** **PADUCAH**, Ky.

One worker collapsed on the factory floor, his body ravaged by lymphoma. Two others died within 105 days of different forms of leukemia. By the time Challie Freeman came down with a rare bone disease in the fall of 1979, questions had morphed into suspicions:

Was something at the U.S. government's uranium plant making workers sick?

One possible answer--radiation exposure--seemed persuasive to Freeman's doctor. He fired off a letter to the **Paducah** Gaseous Diffusion Plant. "It is imperative," he wrote, "that we learn as soon as possible the extent, nature and type of radiation to which he was exposed."

The reply--"no significant internal exposure"--was brief and emphatic. It was also false.

Plant Hid Risk From Workers; Paducah Bosses Knew Some Had High Radiation Levels The Washington Post  
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While the plant was denying knowledge of significant hazards to Freeman's doctors, confidential records showed the opposite: Freeman had tested positive multiple times for exposure to radioactive uranium and had even been restricted from working around uranium, an internal company memo shows.

In August, The Washington Post reported that **Paducah** workers were unwittingly exposed to highly radioactive plutonium and neptunium on the job from the 1950s to the 1970s. A subsequent four-month Post investigation has found additional evidence that plant officials kept employees uninformed about chemical and radiation hazards. In some cases, such as Freeman's, the plant withheld accurate medical information on radiation exposure—even while it privately tracked cancer deaths among workers.

A limited review of **Paducah** employee death records also turned up rates of leukemia among workers that appear higher than normal, based on government mortality statistics. Epidemiologists who reviewed the findings described the data as intriguing but cautioned that a much more intensive scientific study was needed, involving investigators with full access to employee records and medical histories, to establish whether a pattern existed. Such a study has not been done at **Paducah**.

The 48-year-old uranium plant is the subject of an Energy Department investigation into worker health and safety practices. Union Carbide Corp., which allowed its operating contract to expire in 1984, declines to comment, saying its **Paducah** managers are long gone from the company. Energy Secretary Bill Richardson, whose agency owns the facility, has apologized for the failure to disclose plant hazards and has promised compensation for sick workers.

Any outside attempt to review medical issues at **Paducah** is complicated by a lack of complete information. The Energy Department, citing privacy laws, declined to release lists of workers and their assignments. But The Post obtained company rosters listing more than 200 **Paducah** employees who were hired to work in some of the plant's most dangerous uranium-handling areas between 1951 and 1971. Scores of death certificates were examined and more than 120 surviving employees who worked in those areas were interviewed.

Professional help was retained to categorize deaths, and a software program developed by the National Institute for Occupational Safety and Health was used to compare incidences of cancer to national rates.

The result: The incidence of leukemia at **Paducah** appeared elevated, according to epidemiologists who reviewed the data. Of the 211 people on the lists who could be located—about 13 percent of the plant's work force in an average year—10 died of cancers of the blood and lymphatic system, including six of leukemia. By comparison, government mortality statistics suggest that only a single leukemia death would be expected in a group of adults of that size.

Cancer clusters are difficult to document, and cancers are not necessarily caused by radiation. Some studies at other Energy Department plants have suggested links between workplace hazards and cancers; others have not. Whether chronic exposure to low doses of radiation causes cancer has been hotly debated for decades.

Still, several epidemiologists who reviewed the results said the unusual incidence of leukemia and other rare diseases suggests the need for a closer look.

"The findings are interesting and noteworthy and are grounds for a more complete study of the question," said David Richardson, an epidemiologist who is researching radiation health effects for the World Health Organization.

Senior Energy Department officials said the findings highlight a major policy dilemma for the agency: whether to pursue more studies or to expand pilot programs to directly compensate workers who get sick. Yesterday, the department announced that it had shifted spending priorities in its fiscal 2000 budget to increase money for health studies and medical monitoring at **Paducah**. However, officials worry that studies may not be the right approach.

"Epidemiology is not going to answer the questions precisely enough," said David Michaels, an epidemiologist and the assistant energy secretary for environment, safety and health.

Energy Secretary Richardson said he has proposed legislation to change the way his agency deals with its sick workers.

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"Instead of fighting claims, we're actually helping workers without the debate about the rates of illness," he said. "The legislation we sent to Congress takes the burden of proof off those who are sick."

Documents obtained in October under the Freedom of Information Act show that Union Carbide began tracking the repeated cancer cases in its work force in the 1970s.

The first to die was Wade McNabb, a 20-year veteran who succumbed to chronic leukemia in 1972. That same fall, another worker died of multiple myeloma, a bone marrow disease.

Alton Henson died of leukemia in 1976. Two years later, three workers--Arvil Bean, Leonard Lindblad and David Wilson--died of leukemia or bone marrow diseases within a span of six months.

By 1982, the company had counted 13 fatal cancers of the blood or lymphatic system out of a relatively stable work force that ranged from 1,200 to 2,000 people. The list appears on a single sheet of paper--stamped "confidential" and copied to senior plant officials--identifying workers sometimes by initials. How Union Carbide intended to use the list is unclear, but the plant's records show no attempt by contractors to investigate possible links between the deaths and workplace hazards.

Meanwhile, plant workers were told everything was fine. When Challie Freeman fell ill with his deadly bone marrow disease at 59, plant officials offered a lot of sympathy but little truth, family members say.

Responding to a hematologist's queries about possible radiation exposure, a plant physician in a letter described Freeman as a "very fine man" whose exposure to hazardous materials had been near zero. Medical records produced by the plant showed "no significant internal exposure," based on years of weekly urine tests for uranium.

Not until 15 years after his death in 1984 did family members obtain his medical records from the Energy Department and learn the full story: Company tests had indeed found high levels of uranium in his body in the 1950s--so much, in fact, that Freeman once had to be moved to a different work area. His widow, Sue, recalls that he was transferred to a different job in the 1950s after being told simply that his urine was "hot."

Freeman's physician, Nashville hematologist John Flexner, remembered that the company's response "downplayed the exposures."

"They made you think there was no way this could be a case of cause-and-effect," Flexner said. "I guess I was naive to think they were telling the truth."

Union Carbide said that it did not have the ability to respond in the Freeman case because of the 20-year passage of time.

Plant policies required that workers exposed to certain amounts of radiation be moved to other, less hazardous jobs. But new records show this was ignored in some cases in which workers received up to twice the maximum dosage.

One who never got the word was A.B. Burris, a 74-year-old retiree who learned of his past exposures when he asked the Energy Department for his medical files this fall.

"They say I was put on 'strict restriction,' but I never found out about it until weeks ago," he said. "I can tell you they never changed my job or said anything to me about it."

Workers knew even less about potentially deadly plutonium and neptunium that spread through the plant in shipments of recycled nuclear reactor uranium fuel from the 1950s to the 1970s, plant documents show.

Confidential, 40-year-old memos released by the Energy Department in September showed that Union Carbide officials had decided against testing workers for exposure to the radioactive metals because of fears that workers would "use it . . . as an excuse for hazardous-duty pay."

Newly released memos show that senior managers were aware of the plutonium and neptunium problem as early as 1959 but concluded in classified studies that contaminants were not a health hazard because the amounts in each shipment were small--a maximum of 10 parts per billion of plutonium in each uranium shipment.

But over the years, the two metals began accumulating in soil and waste materials.

Plant Hid Risk From Workers; Paducah Bosses Knew Some Had High Radiation Levels The Washington Post  
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In a survey of **Paducah** plant buildings conducted in the early 1990s, more than half of the work areas sampled exceeded the plant's safety limits for plutonium and neptunium--in some cases by a factor of 10. A survey of a men's locker room found high levels in shower stalls and even on toilet seats.

Workers did know enough about radiation hazards to formally request additional safeguards.

When Union Carbide decided to stop providing mechanics with coveralls, the plant's union demanded in 1986 that the company take responsibility for "radiation carried into our homes, autos and other areas." Union Carbide denied the request, although in 1975 the union negotiated the right to protective clothing on demand.

The union was less successful in efforts to secure workers' rights to take regular breaks in a radiation-free lunchroom. In a written grievance in 1979, the union said workers "should not have to eat in a contaminated area."

The company denied the request.

Ailing workers in the past have had difficulty proving harm because they lacked accurate monitoring data, David Fuller, president of the **Paducah** chapter of the Paper, Allied-Industrial, Chemical & Energy Workers Union, testified at a Senate hearing on **Paducah** in October.

While applauding government promises to financially aid ailing **Paducah** workers, Fuller and other union officials called for a compensation program for all workers that "reverses the burden of proof onto the government" while expanding medical monitoring for those most at risk.

"Monitoring is imperative," Fuller said, "but without any other remedy, monitoring is simply a process to watch people get sick and die."

Director of computer-assisted reporting Ira Chinoy, database editor Sarah Cohen, and staff researchers Alice Crites, Nathan Abse and Nancy Shiner contributed to this report.

Challie Freeman

Job: Cascade worker, security officer

Age at death: 64

Illness: Myelofibrosis

Did radioactive exposure on the job make Challie Freeman sick? His doctor suspected a link, but plant managers said no. Asked by doctors to provide details of Freeman's work history, a Union Carbide memo described light exposure to the skin but "no significant internal exposures."

Fifteen years after Freeman's death, the family obtained confidential plant memos that showed the opposite: Freeman had been restricted from uranium work in the 1950s because of "repeated positive urine samples" for radioactive uranium. The uranium remained high after weekends away from the job, the memo said.

Freeman became sick from a slowly progressing bone marrow disease in the 1970s and died in 1984. Near the end his weight plummeted from 190 pounds to 100 and he was in constant pain, said his wife, Sue, who quit her job to care for him. 'We always wondered if it was the plant that made him sick,' she said. 'Now I have no doubt.'

David R. Wilson

Job: Cascade operator

Age at death: 54

Illness: Lymphosarcoma

Like most **Paducah** workers, Wilson said little about his job, though sometimes he'd confide to his wife when he was exposed to unusually high levels of radiation. "He would say just he had been 'hot,'" remembers his widow, Winnie. One day in early 1978 he was rushed to the hospital after becoming ill at work. Tests confirmed he suffered from a form of lymphoma, which ended his life just four months later.

Wade McNabb

Plant Hid Risk From Workers; Paducah Bosses Knew Some Had High Radiation Levels The Washington Post  
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Job: Cascade operator

Age at death: 55

Illness: Leukemia

The doctor's eyes spoke volumes. After breaking the awful news to McNabb -- a diagnosis of leukemia at age 40 -- he asked the ailing man where he worked. The reply, "Atomic Energy Plant, **Paducah**," prompted a nod and a knowing look. "Oh, yes," the hematologist said, "I'm treating several patients from Oak Ridge," **Paducah's** sister plant in Tennessee. McNabb began treatment and returned to the same job to preserve his salary and health benefits. "We didn't know what else to do," Dove, his widow, says. "You couldn't even talk about it at work, not if you wanted to keep your job."

Jack Owens

Job: Cascade operator, emergency crew

Age at death: 36

Illness: Rare blood/bone marrow disease

Owen's emergency crew job brought him into some of the most dangerous areas to clean up spills of chemicals and radioactive material. "Some days he'd come home with chemical burns at every orifice," remembers his widow, Norma Rebik. "Later, when his doctor asked what he had been exposed to, he said, 'Everything.'" In 1961, at 36, he died of a form of thrombocytopenia, a condition sometimes linked to environmental exposures. "He went from perfectly well to dead in a week," his widow said.

Leon Lindblad

Job: Cascade supervisor

Age at death: 62

Illness: Leukemia

An avowed believer in **Paducah's** "mission," Lindblad was ambivalent about whether the plant posed risks. "He'd say the radiation levels were not that high," remembers his widow, Virginia, and yet, he always "took his shoes off at the door because he didn't want to bring that stuff inside the house." Lindblad's suspicions multiplied after he became sick with leukemia. He drew up a list of accidents and dates. "If I die, you can sue them," Lindblad explained to his wife, "because they're the ones who did this to me." Virginia never got the chance: On a Friday in 1976, Lindblad stashed the list in his desk, never suspecting that he would become gravely ill over the weekend. He never returned to work.

C. Arvil Bean

Job: Process maintenance

Age at death: 64

Illness: Leukemia

Bean's retirement plans included firing up the '49 Cadillac he was restoring and taking his wife on a trip to the Dakotas, where he was once stationed with the Army. Those ambitions faded the day he was diagnosed with acute leukemia at age 55. He replayed in his mind the times he had been exposed to radiation -- like the day he worked 16 hours cleaning up radioactive debris from a 1962 explosion. Despite his illness, Bean clung to his vacation dreams to the end. "Every few days he'd go out there and crank up that old car," daughter Nita said, "even in the snow."

Charles Edward Harris

Job: Machinist

Age at death: 62

Illness: Cancer, multiple organs



Plant Hid Risk From Workers; Paducah Bosses Knew Some Had High Radiation Levels The Washington Post  
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For 25 years, Harris worked in the plant's machine shop, grinding down and repairing the nickel-plated pipes and gear used to convert uranium powder to nuclear fuel. Unknown to Harris and most other workers at the time, the metals were contaminated with small amounts of plutonium and neptunium, radioactive elements far more dangerous than ordinary uranium. His son, David, may have been exposed to the same hazards during summer jobs at the plant: College students mowed grass and cleaned up pond sludge in areas now known to be contaminated with the highly radioactive metals. "At the time they told us point-blank there was nothing there but uranium," David said.

Eugene Ragland

Job: Chemical operator

Age at Death: 49

Illness: Lung cancer

The accident and Ragland's death will always be connected, at least in the mind of his widow, Marie. She still remembers his worried voice the night in March 1978 when he called to say he wouldn't be coming home from work. Ragland had been exposed to radiation during a mishap and had been asked to stay overnight for testing. Four months later, a separate medical test found "something wrong" with his blood, she said -- a result that led to the discovery of a rapidly spreading cancer in his lungs and chest. His death on Aug. 4 came so suddenly that Ragland had little time to ponder his illness, or the possible causes. "He always thought he was safe at the plant," Marie said. "They never let him know differently."

When Challie Freeman got sick, **Paducah** managers claimed he had suffered "no significant" radiation exposure, above, even though years earlier they had restricted his work near uranium, as noted below, because his urine had tested "hot." The body of **Paducah** plant worker Joe Harding was exhumed in November for tests. He had feared that the cancer that eventually killed him in 1980 was caused by radiation exposure.

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## Bomb Part Storage at Ky. Plant Disclosed; Nuclear Agency Is Told of Hazards In Secret Program

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Bomb Part Storage at Ky. Plant Disclosed; Nuclear Agency Is Told of Hazards In Secret Program The  
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More than 1,600 tons of nuclear weapons parts reportedly lie scattered around the Energy Department's **Paducah**, Ky., uranium plant, a safety manager informed regulators yesterday in a new disclosure of potential hazards unknown to workers or civilian plant supervisors.

Some of the bomb parts are stored in above-ground shelters and could pose a risk of exposure or even an accidental nuclear reaction at the plant, if the components are contaminated with radioactive substances such as enriched uranium and plutonium, the official reported in a signed statement to the federal Nuclear Regulatory Commission.

The U.S. Enrichment Corp. (USEC), the government-chartered private company that now runs the plant, acknowledged yesterday that its senior officials recently discussed the issue with the Department of Energy.

"USEC has been assured that DOE is not aware of any conditions that create a radiological hazard to USEC personnel at the site beyond those already known and controlled," company spokeswoman Elizabeth Stuckle said.

Energy Department officials involved with the country's classified nuclear weapons program apparently were aware of the shipment of bomb components to **Paducah** over many years, but the department did not until recently inform the plant's civilian overseers and safety officials who were in charge of evaluating threats to workers.

The statement by Raymond G. Carroll, a senior manager of health and safety programs at the plant since 1992, quotes a conversation with another senior civilian plant official who reportedly told Carroll he was worried about the bomb parts after hearing of their existence from a DOE official.

Carroll also said he was told that DOE officials recently began hauling away documents related to weapons dismantlement.

A DOE spokesman confirmed that the department is investigating "classified national security programs" conducted at **Paducah** in the past, along with the Justice and Defense departments.

"This review includes the examination of potential worker exposures and any safety, health and environmental issues associated with these national security programs," the official said.

Carroll's statement was obtained by The Washington Post yesterday as the government was making its most detailed acknowledgment to date of historically unsafe practices at the **Paducah** Gaseous Diffusion Plant, a hulking industrial complex that has produced enriched uranium for nuclear bombs and power plants since 1952.

The 77-page DOE report faults a "climate of secrecy" for keeping workers and neighbors uninformed and unprotected while radioactive contaminants spread through factory buildings and surrounding areas. A few volunteers were deliberately exposed to uranium in a series of previously undisclosed human experiments, the report said.

The DOE report does not mention nuclear bomb parts. A worker lawsuit against plant contractors last summer revealed that some weapons parts had been melted down at the plant to recover gold and other metals. But details of the scope and purpose of the bomb program have remained shrouded in secrecy.

Both DOE and Justice are investigating whistleblower allegations of improper handling of radioactive waste at the plant.

Yesterday's disclosure by Carroll suggests the bomb program may have introduced yet another unknown hazard at a facility where workers had been lulled by assurances that their jobs were virtually risk-free.

"Personnel could conceivably encounter highly enriched uranium or plutonium (or even tritium) without even knowing it," said Carroll, a 30-year veteran of the nuclear safety field who now works for USEC. Tritium is a radioactive component of the hydrogen bomb.

Carroll, in a five-page memo filed with NRC and DOE officials, said he learned about the bomb parts from a senior USEC supervisor, radiation protection manager Orville Cypret. Carroll wrote that Cypret said he learned about the bomb parts from Dale Jackson, the former DOE manager of the **Paducah** site.

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Carroll said Cypret told him that 1,600 tons of weapons components had been shipped to **Paducah** since the 1950s. Although some parts were buried, others were dispersed in various storage areas across the sprawling complex, according to Carroll's statement.

Cypret became alarmed after a Justice Department investigator told him "he would not ask about a 'classified tritium project' or past nuclear weapons handling at **Paducah**," Carroll wrote in his statement.

In keeping with security policy, the weapons parts were not labeled, though "DOE thinks it knows where most of the material is," Carroll wrote.

Cypret and Jackson did not return phone calls from The Post. A Justice Department official in Louisville said he could not comment on the department's investigation into whistleblower complaints at the plant.

Carroll said he was told that "large quantities" of plutonium and highly enriched uranium had been brought into the plant, and "not just in reactor tails." Last summer, following allegations by current and former workers, DOE acknowledged for the first time that radioactive plutonium and neptunium had entered the plant in uranium "tails," recycled uranium metal from military reactors that produced plutonium.

Carroll said in his statement that Cypret said a team of DOE officials had been assembled to investigate the matter but their findings "would not be voluntarily shared" with the plant's civilian managers. Instead, as records relating to the bomb program were found, they were held in a special vault for classified material.

"Someone from [the DOE's Oak Ridge, Tenn., site] would drive down each night to pick them up," Carroll wrote, quoting Cypret.

Carroll said the new disclosures had left him deeply concerned about the safety of the plant's workers. Besides the risk of radioactive contamination, improperly stored nuclear material could trigger a lethal "criticality," an accidental nuclear reaction.

"A decision had apparently been made that national security would take precedence over personnel radiological safety," Carroll wrote. "I find this situation to be unconscionable."

The risk posed by weapons parts could range from high to minimal, depending on the materials and how they are stored.

DOE's report on historical practices at **Paducah** wraps up the second of two major probes ordered by Energy Secretary Bill Richardson in August. DOE officials described it as one of the most thorough in the department's history.

The report concludes that the plant's lapses in worker safety in many ways reflected the culture of the time. "The Cold War was a reality," and federal oversight of the plant "was primarily directed at cost, schedule and production," the report said.

Although the "intention to protect workers was apparent," plant managers frequently failed to meet even the relatively lenient safety and environmental standards of the day, the report states.

The risks posed by plutonium and neptunium were "neither fully understood or appreciated," the report states. "The presence of these materials, the increased risks involved and the rationale for additional controls was not shared with workers."

In addition, radioactive and chemical wastes were routinely discharged into the water and air. Investigators documented nighttime smokestack emissions--dubbed "midnight negatives"--involving tens of thousands of pounds of uranium dust and smoke.

Richardson said the findings underscore his efforts to win compensation and other aid for ailing workers.

"I'm going to continue to be up front with the **Paducah** workers and the community about environmental, safety and health conditions at our sites during the Cold War," he said.

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