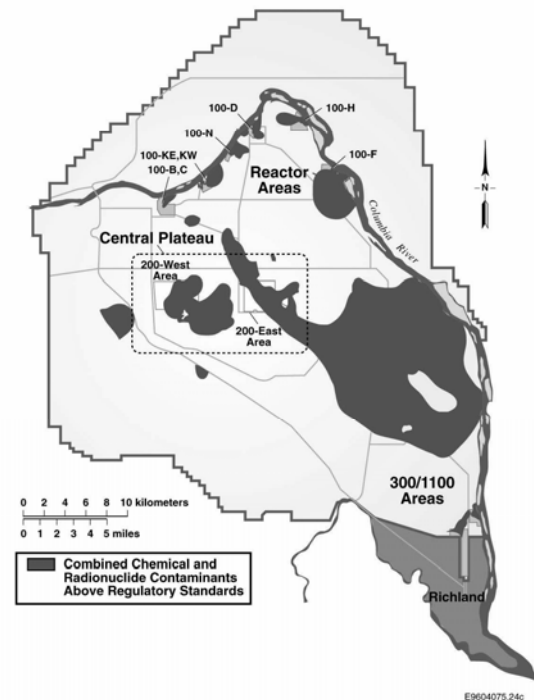


Hanford: the most contaminated area in the Western Hemisphere

- Overview of Groundwater Risk & Legal Issues
- Gerald Pollet, JD;
ExecDirector,
Heart of America
Northwest
April, 2007 UW Water
Seminar

Combined Distribution of All Contaminants in Groundwater on the Hanford Site



Numerous Water Risk Issues:

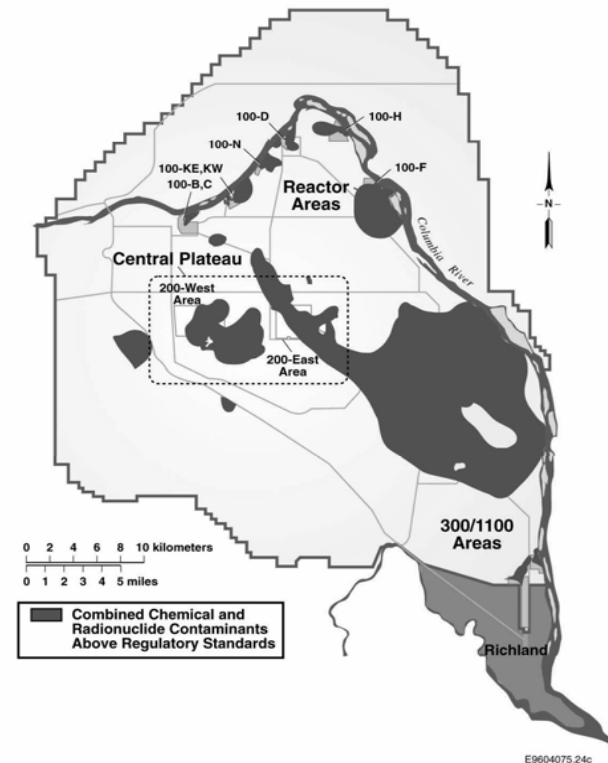
- Groundwater
- Columbia River
- Leaks from High-Level Nuclear Waste Tanks
- Unlined trenches
- Future Exposure and Risk Assessment
 - What Role for Public and Tribes?
- What Standards?
- Any Plan?



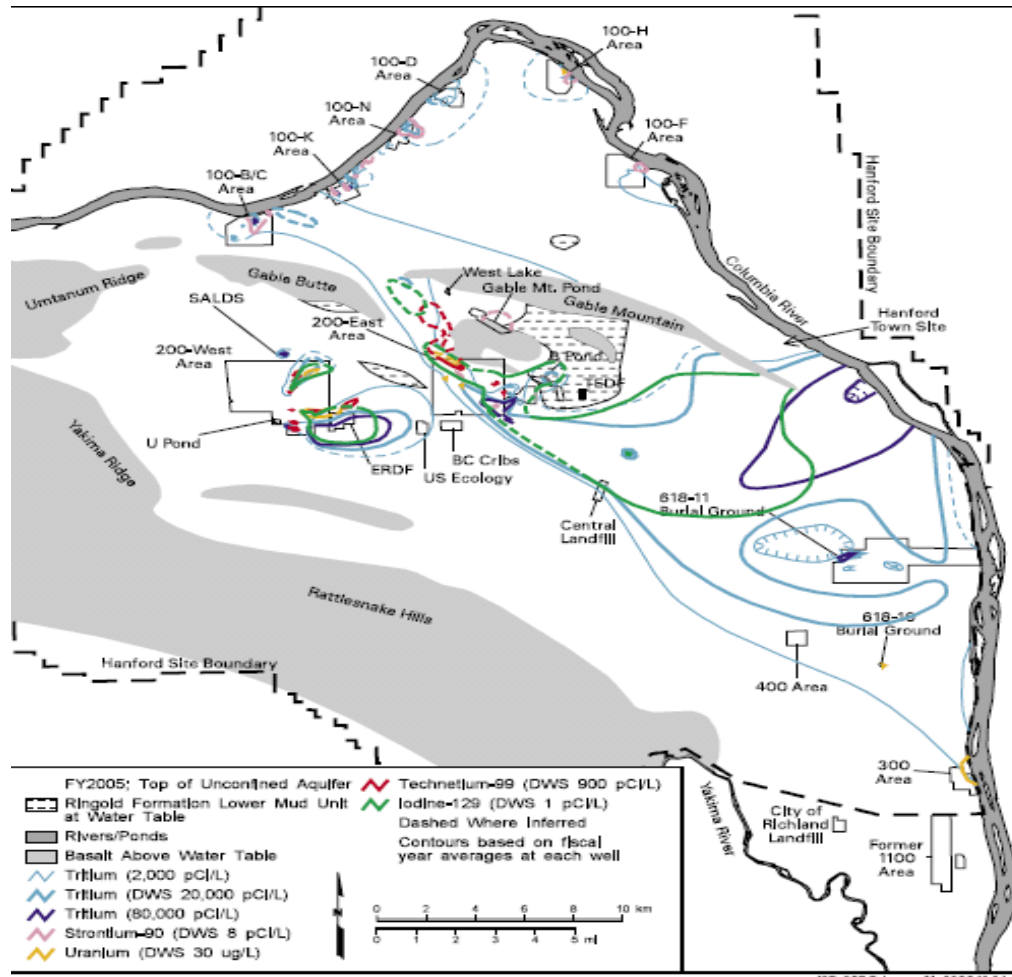
Hanford's Unknown Dangers

- 53 million gallons of waste in Hanford's High-Level Nuclear Waste Tanks; 35 million gallons remain in Single Shell Tanks.
- USDOE admits that over one million gallons of waste has leaked from tanks... How fast and where is it spreading? Will anything be done?
- Over 200 square miles of contaminated groundwater (80+ sq. miles above Drinking Water Standards)... Contamination already entering River at levels >1,000 times DWS for Strontium...

Combined Distribution of All Contaminants in Groundwater on the Hanford Site



80+ Sq Miles Groundwater Contaminated Above Standards...
 Would cover an area as large as the City of Seattle
 No Plan, No Funds, No Schedule to Clean-Up and Restore



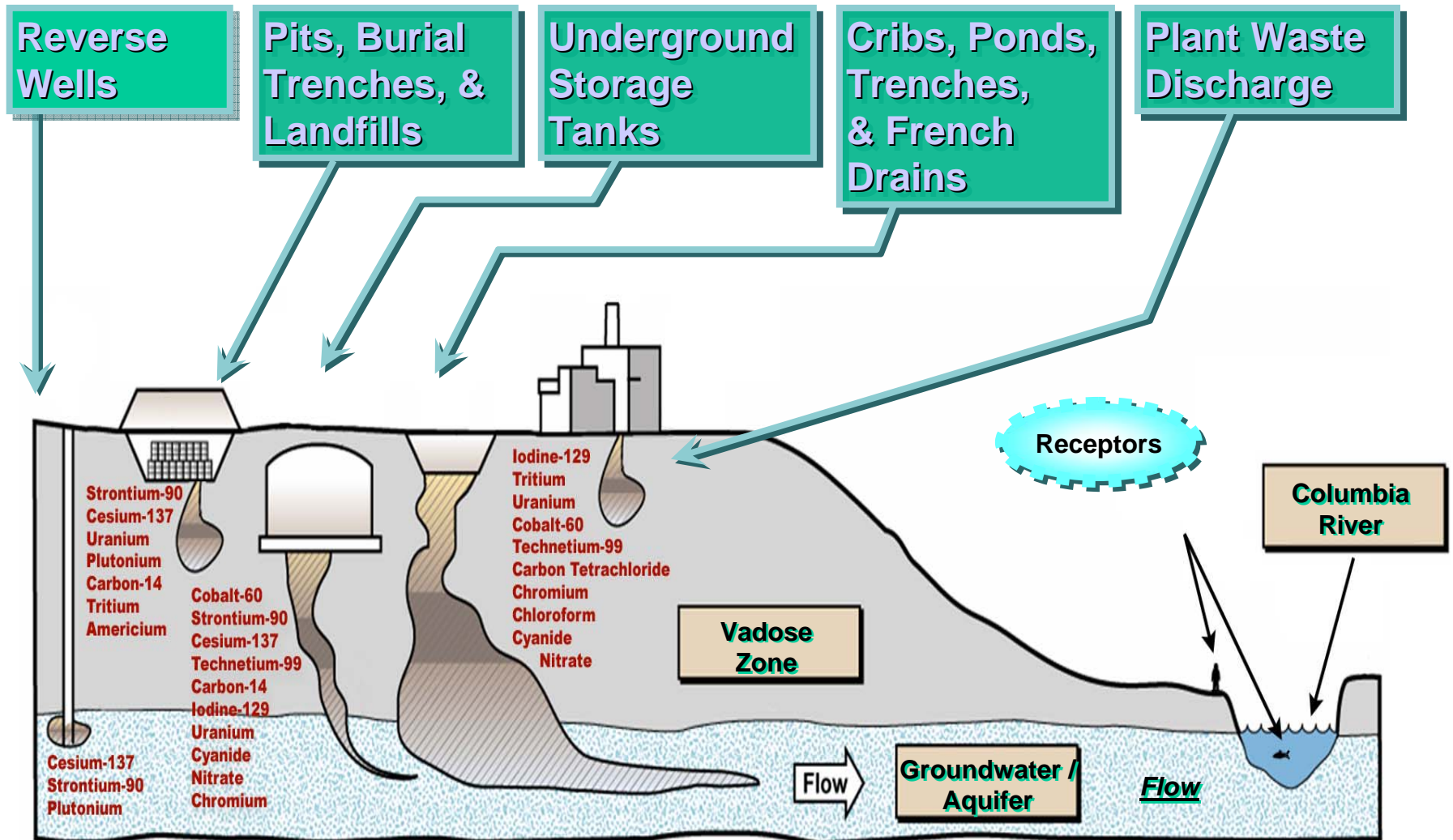
This map shows the distribution of radionuclides in groundwater at concentrations above drinking water standard during FY 2005 in the upper part of the unconfined aquifer.

Columbia River at Risk

- Hanford Reach of the Columbia flows through Hanford for over 50 miles, past nine full scale nuclear reactors, hundreds of liquid waste and burial sites.
- Hanford Reach National Monument
- Contaminants entering River along shore at levels $>1,000$ times Drinking Water Standard

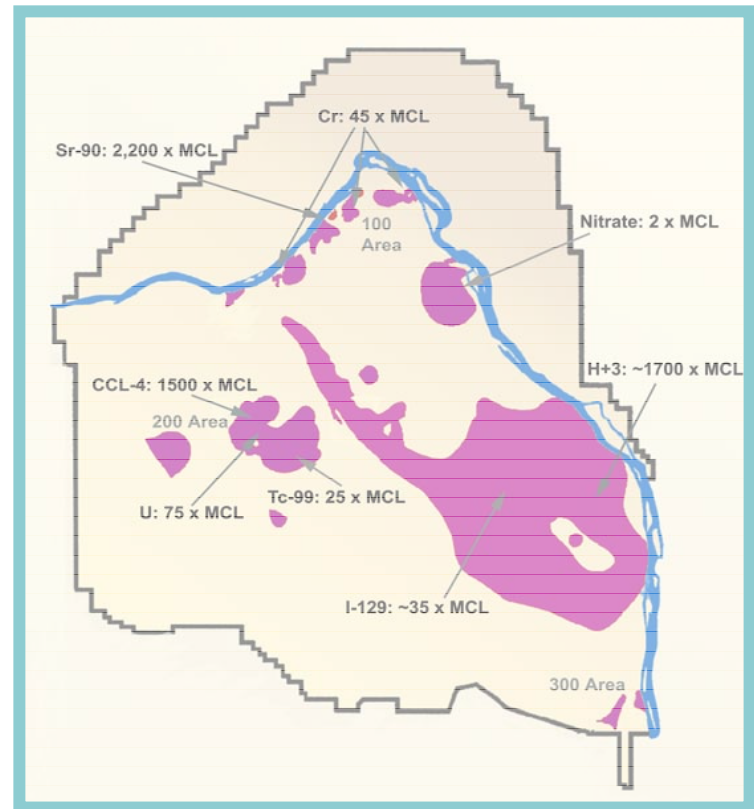


What is our strategy....(Ecology slide)

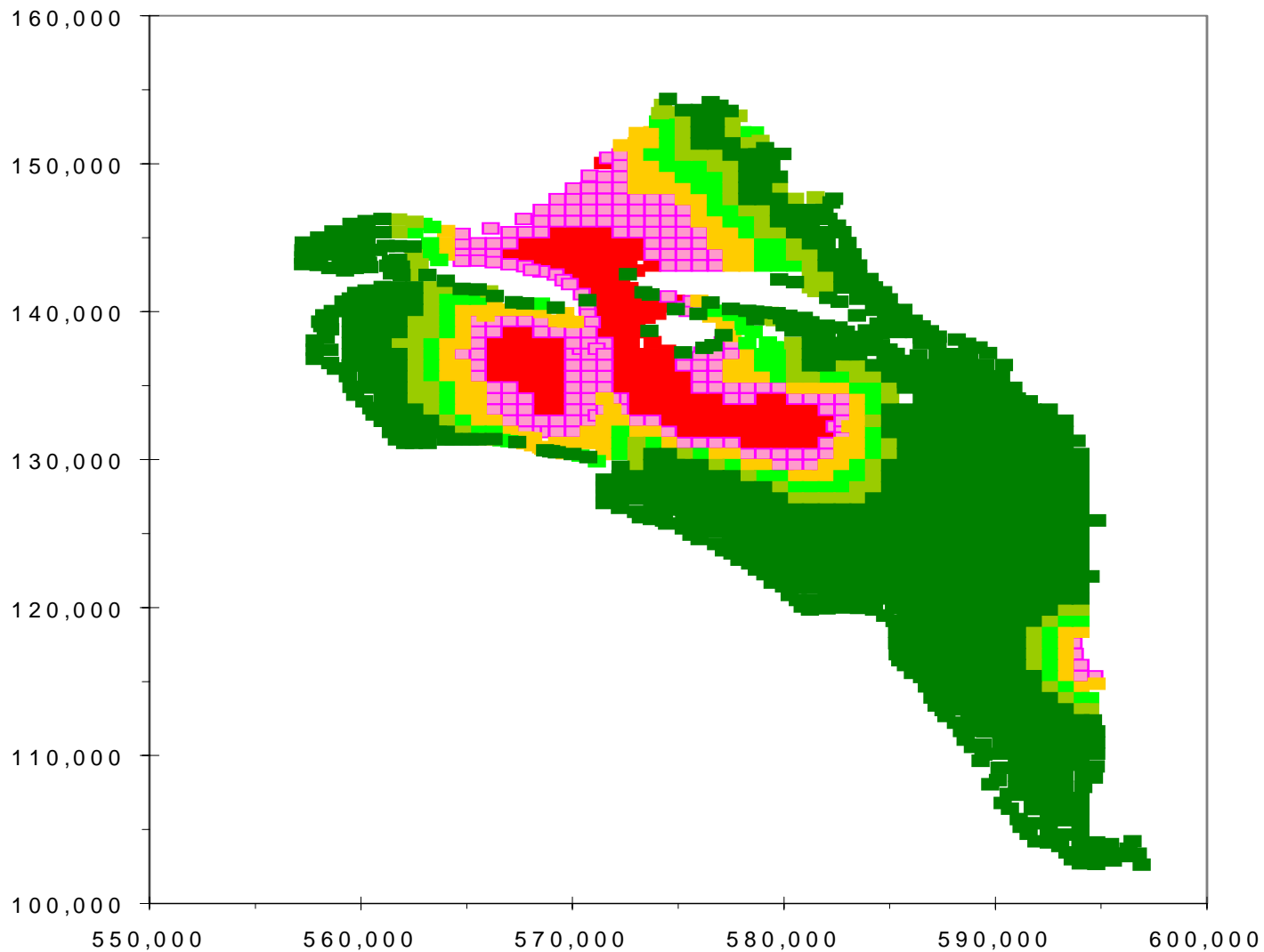
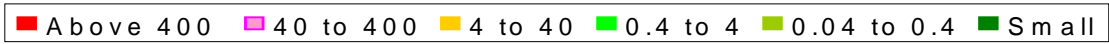


The US Department of Energy's Hanford Clean-Up proposed budgets through 2011 and long term plans, called "baselines",
do **not include**:

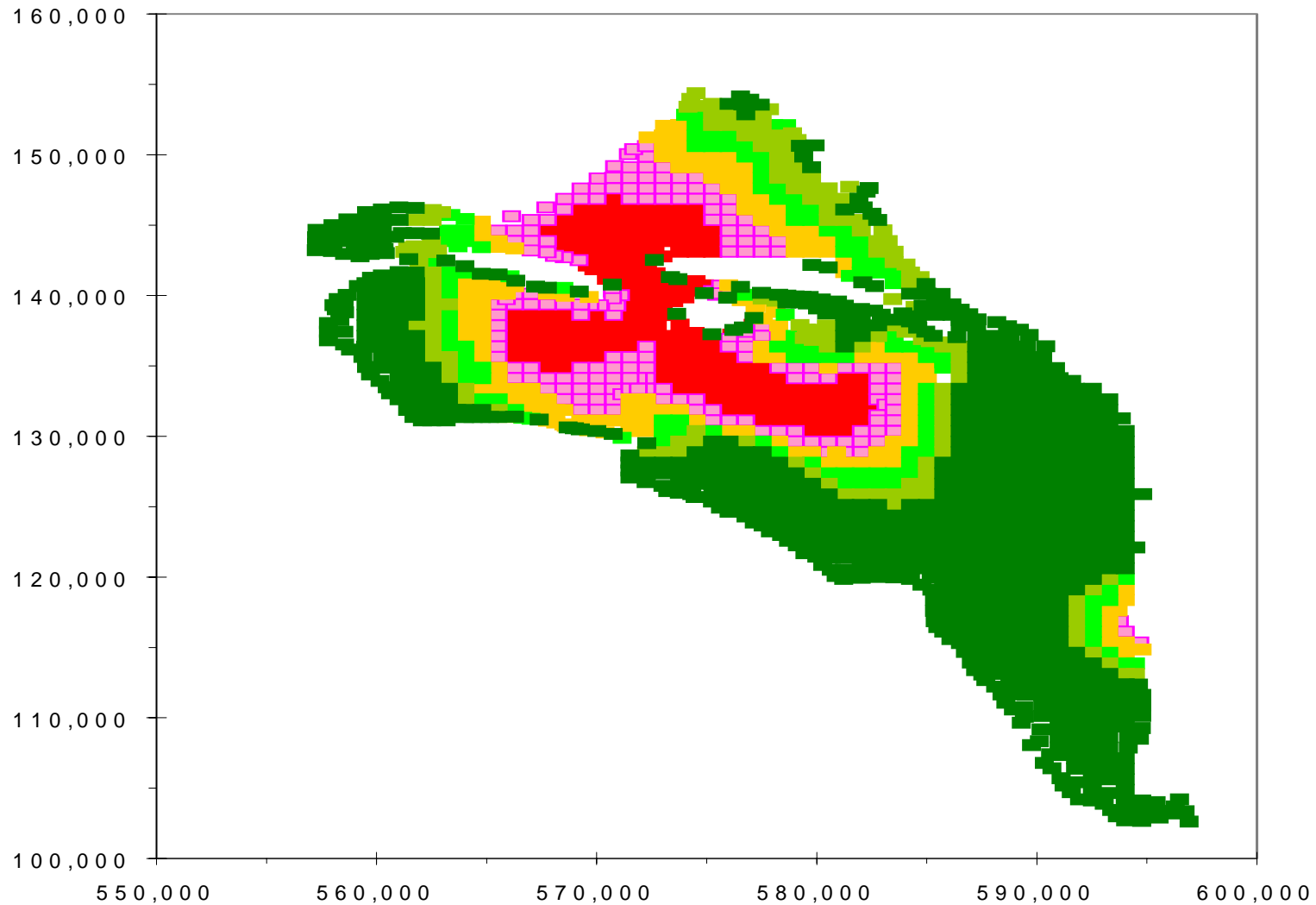
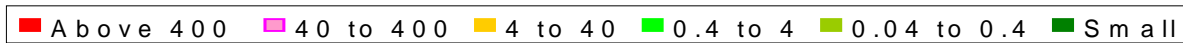
- funds or schedules to ever cleanup over 80 square miles of groundwater contaminated above standards – an area equal to the size of Seattle.



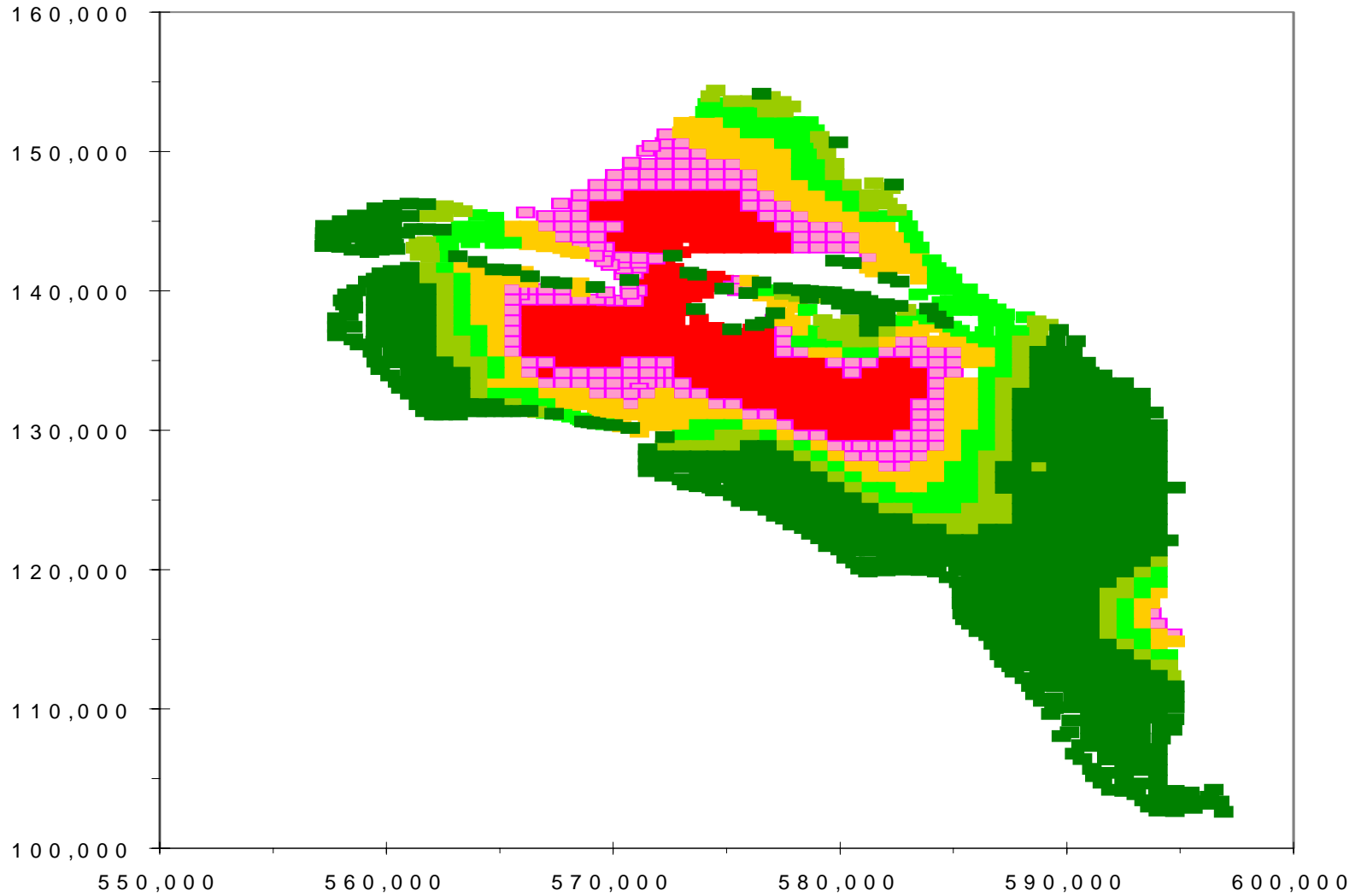
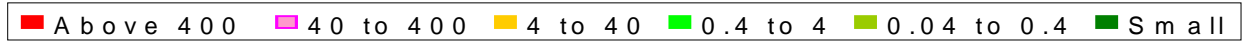
**Individual Drinking 2 L/d Groundwater - All Rads
Year 2000 Mean Annual Dose Rate in Millirem**



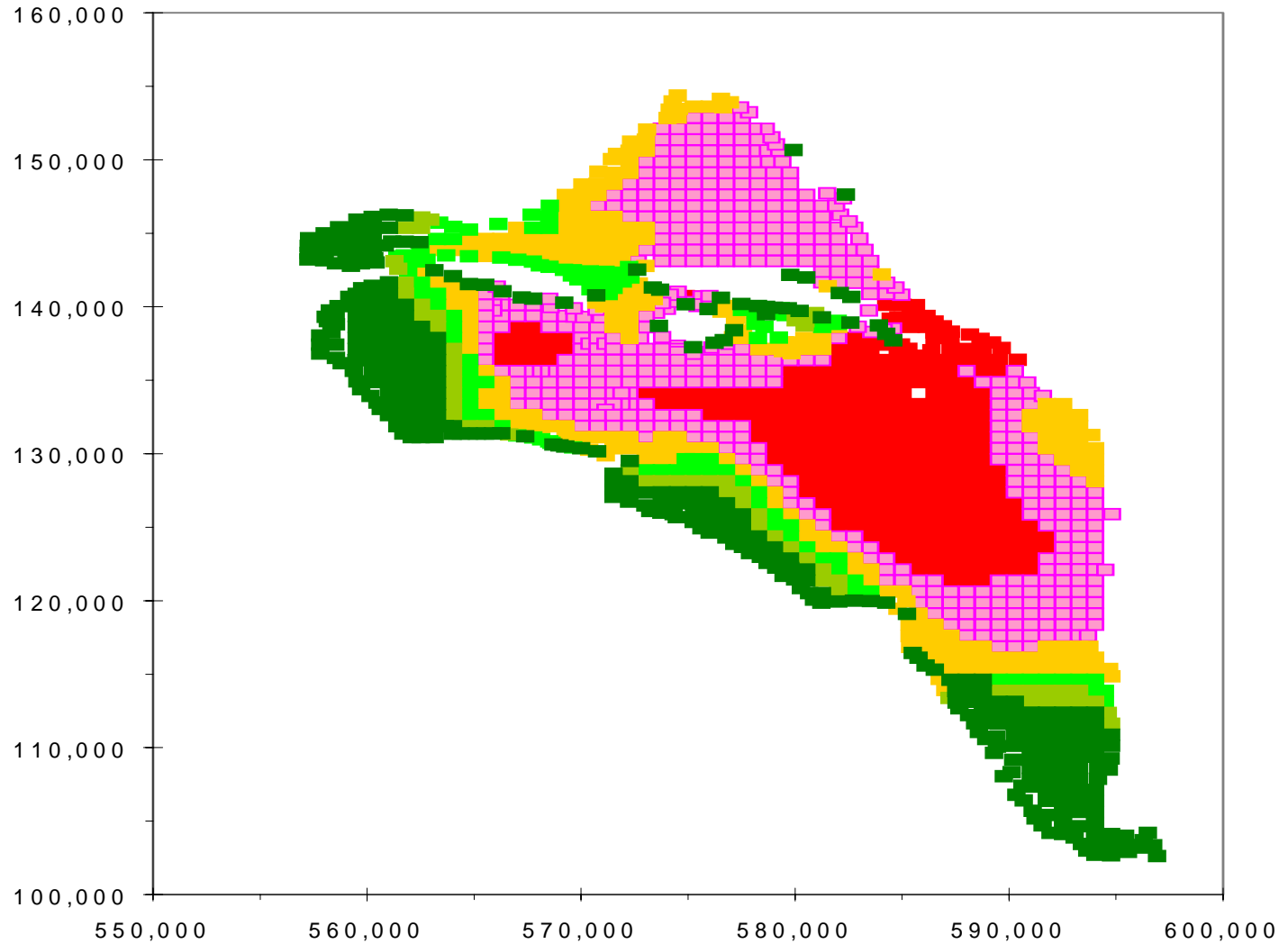
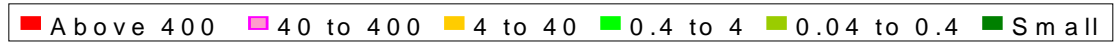
**Individual Drinking 2 L/d Groundwater - All Rads
Year 2040 Mean Annual Dose Rate in Millirem**



**Individual Drinking 2 L/d Groundwater - All Rads
Year 2100 Mean Annual Dose Rate in Millirem**



Individual Drinking 2 L/d Groundwater - All Rads
Year 2700 Mean Annual Dose Rate in Millirem



Secretary of Energy,
Justifying Cutting Funds for Emptying Tanks,
Claimed in Testimony to Congress:

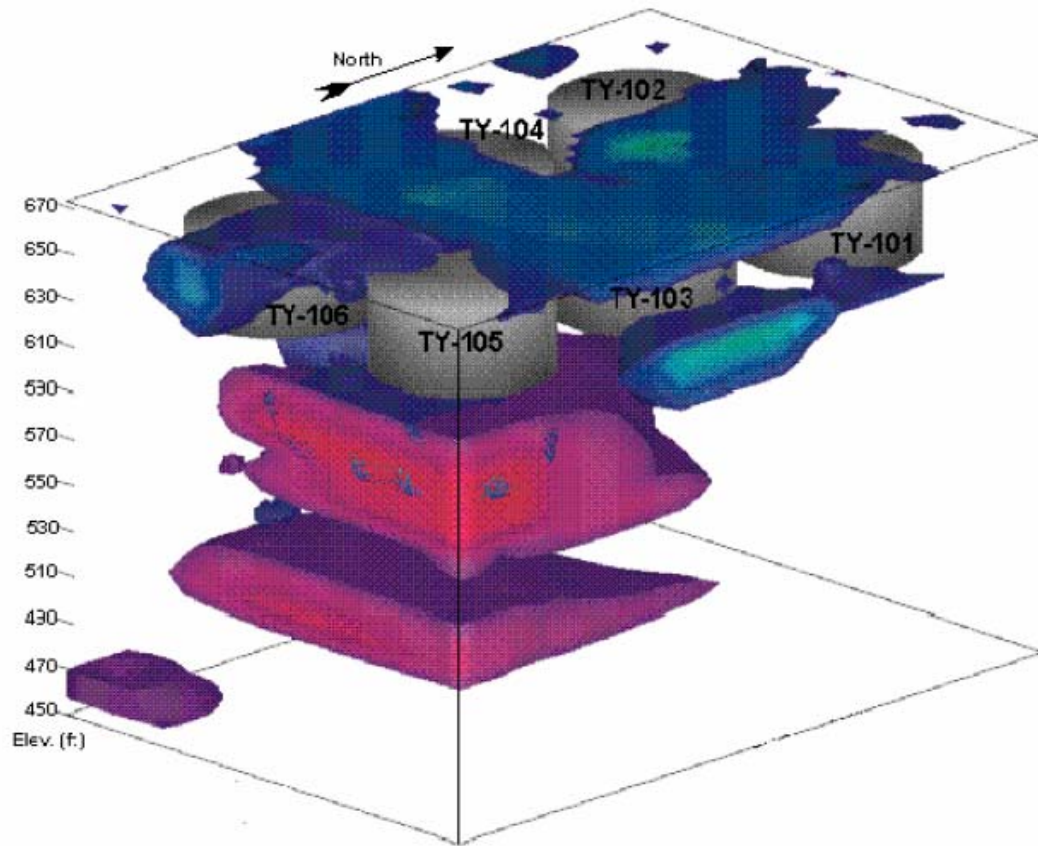
- Single Shell Tanks of High-Level Nuclear Waste Are “Stable”
- Single Shell Tanks are Monitored;
- Tanks Have Not Recently Leaked;
 - “We monitor those tanks for any additional leakage, anything that would indicate any instability, and we find none.”
- Contamination is Not Moving

Testimony of Secretary of Energy Bodman to
Senate Energy Committee Feb 9, 2006

CANTWELL: “So when the Army Corps of Engineers says that it is imperative the project be accelerated and empty tanks as soon as possible, tanks and their contents represent immediate risk in a seismic event, you disagree with that?”

BODMAN: “Yes.”

High-Level Nuclear Waste Tanks Have Recently Leaked; and Contamination is Reaching Groundwater



Example of rapid contamination

TY Tank Farm

- Fifty fold increase, from 1996 to 2002, in contamination found in one borehole tested between Tanks TY-103 and TY-105.
 - Rise in ^{137}Cs concentration
 - One of the tanks had a substantial release; no reporting, a significant violation.
 - Depth of contamination shows source is likely a pipe or tank leak, ... not borehole contamination.
- USDOE also failed to report a release from TY-102.
- Claimed TY farm to be “Controlled, Clean and Stable”.

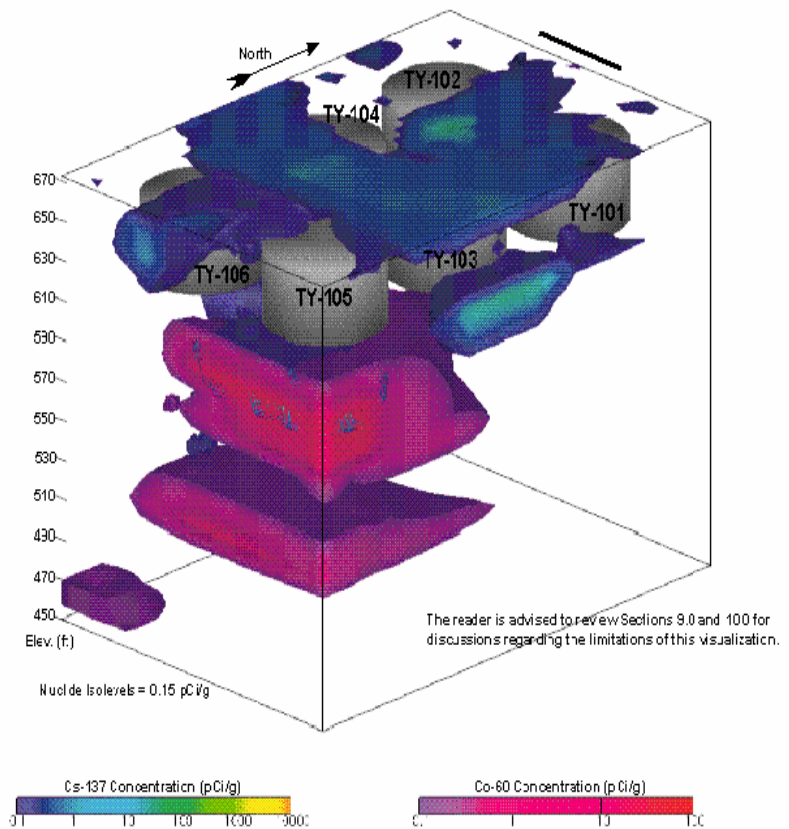
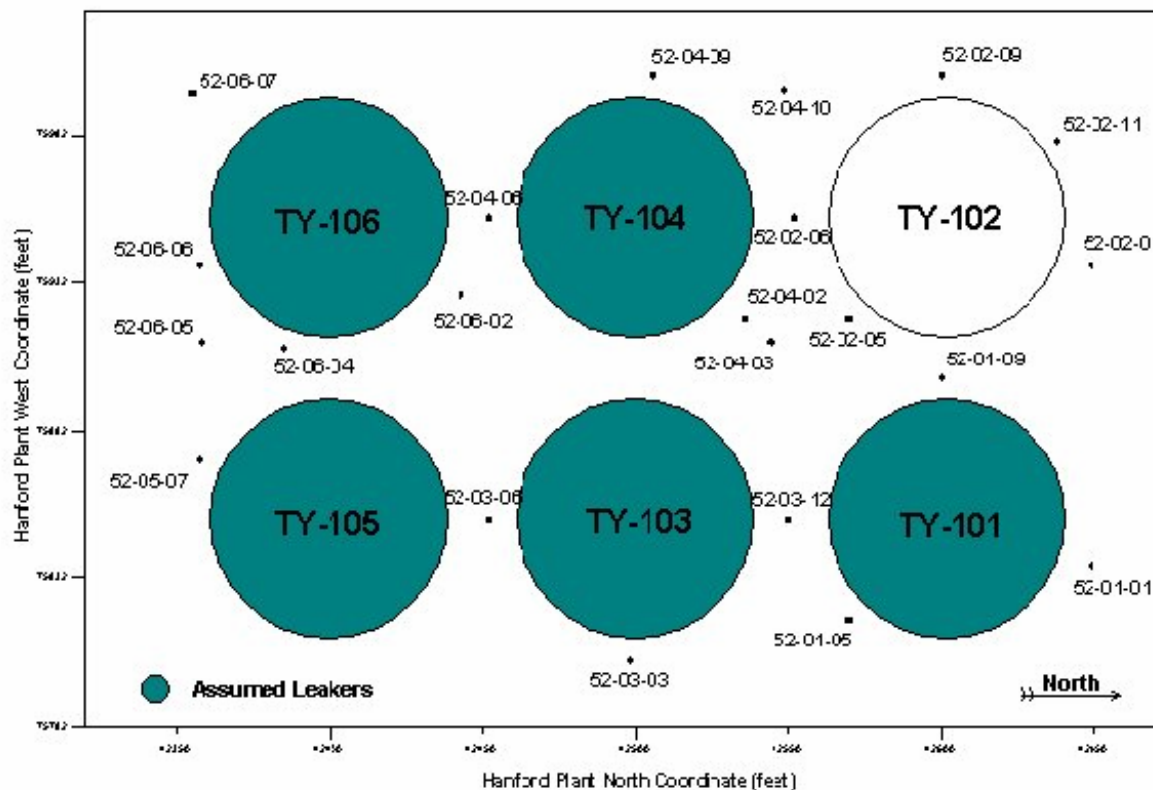


Figure 14-23. Visualization of the Cs-137 and Co-60 Contamination in the TY Tank Farm Viewed From Above the Tanks From the Southeast

TY Tank Farm

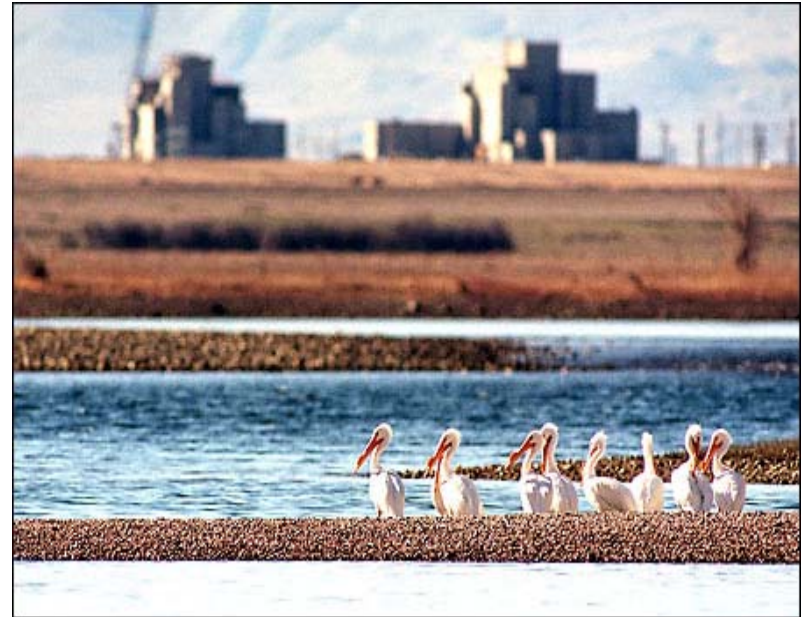


DOE & Contractor cover up of TY-102 Leak

- 1997 Grand Junction Office report:
 - contamination came from subsurface source
 - “most likely resulted from leakage from tank TY-102”
- Development of tank leak designation process and subsequent decimation of that process by DOE and contractors
- “Example of DOE and contractors’ obfuscation, incompetence and outright lies” John Brodeur, LGE
- Ecology’s culpability, absence from the process and failure to regulate the RCRA facilities

DOE Determined Not to Know or Act on the Contamination

- Not a unique opinion: GAO reports also show that DOE was determined not to know.
- Little has changed over past 26 years; DOE still avoids disclosure of tank leaks.
- In 1980, the DOE Inspector General found: “Hanford’s existing waste management policies...keep publicity about possible tank leaks to a minimum.”
- In 1989, the US GAO reported: “DOE does not collect sufficient data...studies...do not provide convincing support...that the impact will be low or non-existent.”
- Detection and contamination characterizing programs deliberately designed to avoid finding leaks.
- Wrong instrumentation and approach proposed for characterization in current plan- aimed at concentrations of Cs ¹³⁷ above 10⁵ pCi/Gm. USDOE RPP-7578. Limited in gamma assay capability.



Deep Contamination Problem

- At the TY High-Level Nuclear Waste Single Shell Tank farm, the data show that ^{60}Co and ^{137}Cs contamination has moved down deep and into groundwater.
- In the assessment of the SX farm, it was determined that the occurrence of very high ^{137}Cs concentration plume as deep as 100 ft.
- Single Shell Tank BX-102 has the third largest acknowledged leak at Hanford.
- Cesium 137 has definitely gone deep into the vadose zone.
- If the ^{137}Cs is deep, where are the more mobile contaminants like uranium?
- Lack of records show that the DQO process at Hanford is broken.

Groundwater Contamination at Hanford

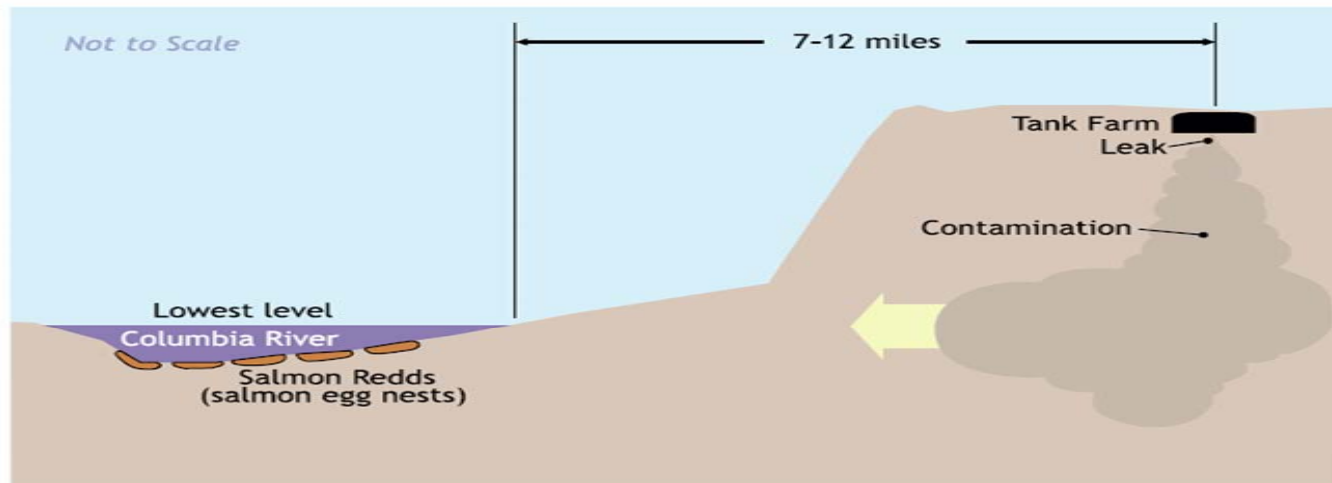
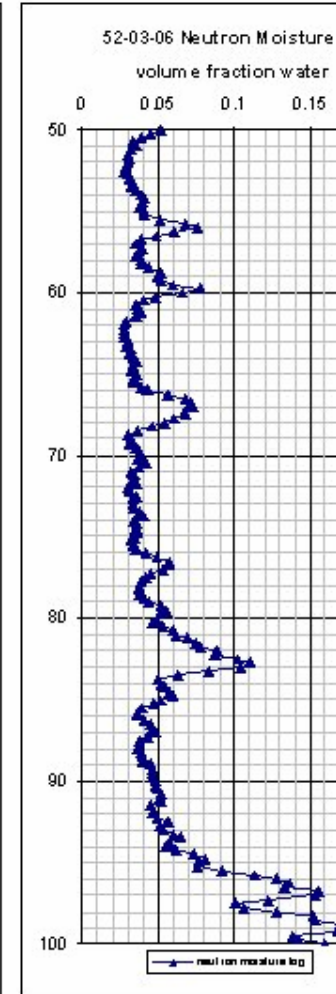
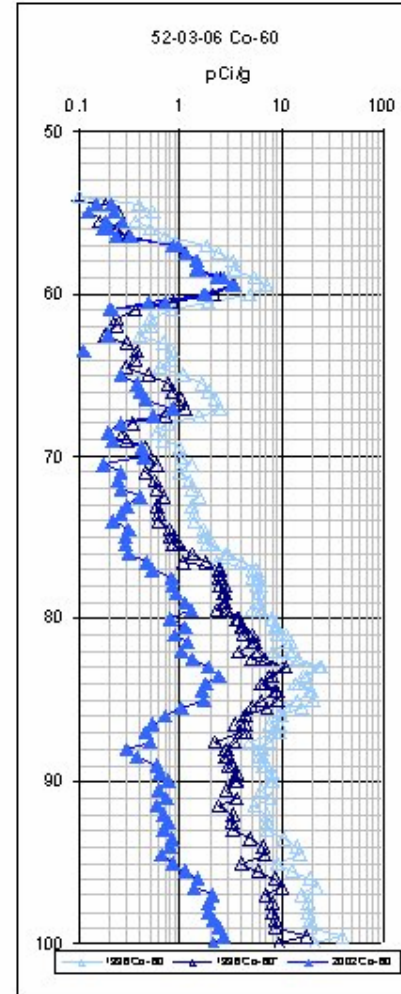
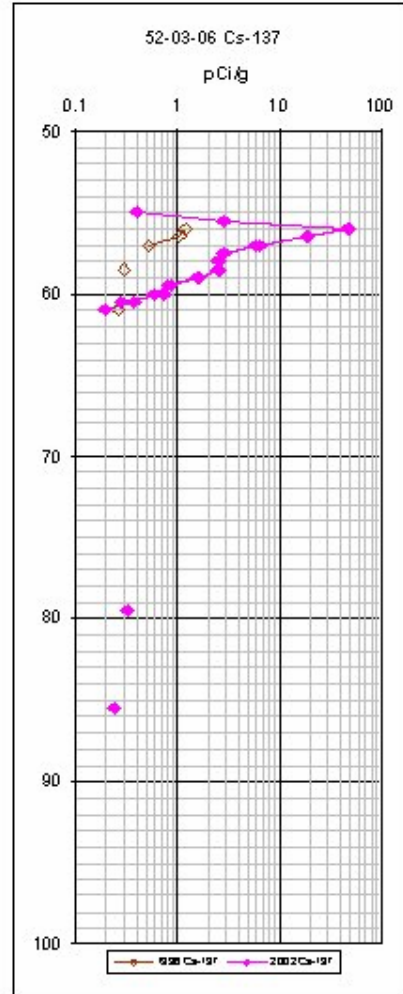
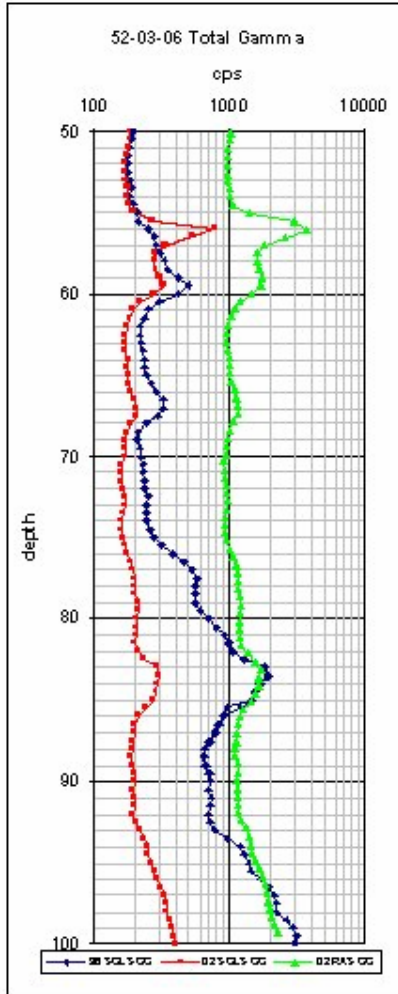


Illustration of how contamination from Hanford waste tanks spreads through water underground.

Ignoring a Recent Leak at TY Tank Farm



Ignoring Deep Contamination at TY Tank Farm

- Borehole Log data show that ^{60}Co and ^{137}Cs contamination has moved down deep into Ringold E and into groundwater
- Boreholes 52-06-05, 52-06-07

USDOE's Characterization Plan

- Under USDOE/contractor plan, the DOE will investigate tank farm Cesium 237 leakage at concentrations of 10^5 to 10^6 picoCuries/Gm.
- Problems:
 - this level is too high; not even known major leaks are at this contamination level.
 - Concentrations of this level at 40 feet underground 10 to 20 years ago will have moved and dispersed.
- The plan also ignores both documented evidence of leaks and the need investigate deep contamination.
- This criteria is designed to NOT find leaks.
 - For example, the penetrometer holes appear to be installed only to 40 ft (RPP-7578) and will miss the primary contamination regions.

Every Claim Made by the Secretary of Energy in
Testimony to Congress, regarding Single Shell
is **FALSE**:

The TRUTH:

- Tanks Have Recently Leaked, They Are **NOT “Stable”**
- Single Shell Tanks are **NOT Monitored**;
- Contamination is **Reaching Groundwater**;
- Between Tanks TY 103 and 105, Gamma Contamination increased **50x** from 1997 to 2002... USDOE failed to report leak.

What to do now

- Obtain adequate leak characterization data before attempting to assess environmental impacts. This will take several years - casting clouds of doubt over: the EIS under way; the USDOE “Performance Assessment”; and, USDOE proposals to use “landfill” closure for tank farms.
- Estimates of curie content of leaks could be made using the empirical characterization data instead of basing those estimates on gross assumptions of the contamination distribution such as what the CH2M Hill vadose zone integration team has recently done in Field and Jones (2005).
- In order to properly complete the remediation or close a site under RCRA or CERCLA and also provide appropriate post closure monitoring of the contamination left behind, it is necessary to understand the nature and extent of the contamination in the vadose zone.
- This must be done before attempting to determine what type of closure plans should be adopted.



The US Department of Energy's Hanford Clean-Up proposed budgets through 2011 and long term plans, called "baselines",
do **not include**:

- having any portion of the vitrification plant operating before 2018, despite calls to have the Low-Activity portion of the plant operational in 2011 in order to treat waste removed from leaking tanks.

USDOE Has No Plan to Cleanup Tank Leaks; USDOE Has No Plan to Fully Empty Tanks

- USDOE Suing to Overturn our State Law, Passed as Initiative 297, Requiring that Tanks be Emptied and Leaks Cleaned Up, “To Extent Practicable”
- USDOE cut funds for emptying Single Shell Tanks -- Deadline to empty all 149 is 2018
- USDOE Not Even Planning on Emptying 2 a Year
- *ACTION: Ecology Needs to Set Enforceable Compliance Requirement to Empty Tanks Each Year, Not Wait For Disaster.*



CLEANUP FIRST!

OVER A MILLION
GALLONS OF LIQUID
HIGH-LEVEL
NUCLEAR WASTE
HAVE ALREADY
LEAKED FROM TANKS
AT HANFORD AND
THE CONTAMINATION
IS SPREADING
TOWARDS THE
COLUMBIA RIVER.



**WE SHOULD CLEAN UP
HANFORD BEFORE ADDING
MORE WASTE...**

**Isn't this existing law, or
existing authority to require?**



UNLINED BURIAL GROUNDS

Cleanup Priority Act, I-297, barred further use of unlined disposal. Required an order with enforceable schedule for investigation (actual characterization), compliant groundwater monitoring... To be followed by order with schedule for remediation.

Is this pre-empted? Before 9th Circuit now...

Yet, Federal Facilities Compliance Act and RCRA, with HWMA rules require the same.



RADIOACTIVE and MIXED WASTE DUMPED DIRECTLY INTO THE SOIL IN UNLINED TRENCHES AT HANFORD.

MTCA Cleanup Standards and Radiation Risk

- Radionuclides are “hazardous substance” under MTCA and CERCLA, when released to the environment
- Cancer risk standard for residual contamination (cleanup standard) applies to ALL carcinogens
- CERCLA: <1 fatal cancer/10,000 (1E-4)
- MTCA: < 1/100,000 (1E-5) total
 - <1E-6 for any one carcinogen

US Says Standards for Cleanup of Radionuclides Contaminating Groundwater are Pre-Empted

- “the preempted field includes ‘uncontrolled’ releases of AEA (radioactive) materials to the environment.”
- “The comprehensive regulatory scheme addressing the... disposal of AEA materials amply encompasses the safety aspects of uncontrolled releases of such substances. Leaks, spills and releases of AEA materials implicate health and safety...” and are preempted by the Atomic Energy Act. US Response Brief to 9th Circuit pg 29.

If Standards for Cleanup of Leaks, Spills and Releases are Pre-empted:

- What standards will apply under USDOE's own "comprehensive regulatory scheme" under the AEA?
- If state standards are pre-empted by AEA, then aren't EPA's Superfund (CERCLA) standards also pre-empted?

What Standard Would USDOE Use for National Dump, and Acceptable Risk from Radiation Exposure?

- Massive New Landfill (IDF) Sought to be Used as National Waste Dump as well as vitrified tank “low activity waste”
- 3 million cubic feet of radioactive and “Mixed” radioactive hazardous waste, which is not from cleanup proposed to be buried in new Hanford landfill (120,000 barrels worth of mixed waste alone)
 - USDOE reserves right to increase to 12 million cubic feet, per “Preferred Alternative” in Hanford Solid Waste Disposal EIS, Feb, 2004; which USDOE has to redo due to admitted major flaws.
 - On top of waste from Hanford tank waste treatment, which is projected to result in releases violating groundwater and DWS standards for Iodine, Technetium – without adding offsite waste.
- USDOE is Fighting to Overturn State Standard – asserts state can NOT apply its health based carcinogen standard, nor EPA use the Superfund standard:

What Standard Would USDOE Use for National Dump, and Acceptable Risk from Radiation Exposure?

- USDOE Objects to Use of State Standard to Protect Against Cancer from Exposure: Claims State is Pre-empted under Atomic Energy Act. Even for long-term performance review in EIS.
- USDOE's self-set standard allows exposure up to 500 mrem per year to public when landfill cover and institutional controls fail (100mrem-500mrem)
 - Washington Dept. of Health fighting us to allow use of same standard as USDOE for unlined LLW dump.
- *USDOE's standard would allow up to 25% of Children Exposed to Contamination from Landfills and Dumping to Get Cancer!!!*

USDOE's standard would allow 25% of Children Exposed to Contamination from Landfills and Dumping to Get Cancer:

- 500 mrem/year: BEIR VII (National Academies of Science, 2005):
- 15 mrem/year of exposure to an adult would be estimated to result in 8 additional cancers per ten thousand exposed adults (8×10^{-4}), or 8 times the EPA standard when considering only exposed adults, and at least 80 times the state MTCA standard.
- BEIR VII confirms linear no threshold model
- Risk from 500 mr/yr = 266 cancers / 10,000 adults
- Risk level of 2.66% for exposed adults...
- Children are 3 to 10 times more susceptible to cancer from the same dose of ionizing radiation or other carcinogens as are adults. [March 3, 2003. <http://epa.gov/ncea/raf/cancer2003.html> "Draft Final Guidelines for Carcinogen Risk Assessment"]].

CERCLA and MTCA require summing ALL carcinogens and presenting one risk

- EPA's CERCLA Guidance states:
“(c)ancer risk from both radiological and non-radiological contaminants should be summed to provide risk estimates for persons exposed to both types of carcinogenic contaminants... risk estimates contained in proposed and final site decision documents (e.g., proposed plans, Record of Decisions...) should be summed to provide an estimate of the combined risk to individuals presented by **all** carcinogenic contaminants.”

US Environmental Protection Agency;

OSWER 9200.4-18, Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination, Aug 22, 1997. At 4. (parenthetical and bold emphasis in original).

5 Year Review and Cancer Risk - Revision of Cleanup Action Levels Necessary

- Current plans use cleanup level of 15 millirem annual exposure
- = an additional 3 to 5 fatal cancers per ten thousand persons exposed (e.g., $3E-4$) based on prior NRC and EPA accepted guidance
- Clearly exceeds the CERCLA risk range, but EPA avoided this by saying 15 mrem “generally achieves” NPL risk range

Cancer Risk – Decisions Allow Much Higher Risk at Hanford than Elsewhere

- Hanford decisions allow 15 millirem annual exposure = an additional 3 to 5 fatal cancers per ten thousand persons exposed ($3E-4$), calculated on old data
- BUT, Hanford Clean-Up “Records of Decision” allow 15 mrem for rad ***PLUS exposure to the maximum cancer risk from hazardous chemical exposures.***
- So the radiation cancer exposure risk is on top the maximum allowable cancer risk.

New National Academy of Science Consensus Report Increases Risk / Dose

- Requires revision of cleanup and remediation action levels.
- Even if prior decision met risk range, new data would put residual contamination outside NPL risk range and far outside MTCA allowable risk
- Means can not call areas available for unrestricted use, unless revise.

New National Academy of Science Consensus Report Increases Risk / Dose

- BEIR VII (seventh Biological Effects of Ionizing Radiation) report on "Health Risks from Exposure to Low Levels of Ionizing Radiation"
- 15 mrem/year of exposure to an adult would be estimated to result in 8 additional cancers per ten thousand exposed adults (8×10^{-4}), or ***8 times the EPA standard, and at least 80 times the state MTCA standard.***
- Children @ 3-10x greater risk for same dose

USDOE Response to HoANW comments to 5 Year Review calling for revising cleanup levels and risk decisions based on BEIR VII:

- Response to Comments on Five Year Review, Nov. 2006:
“The NRC in its review of the BEIR VII Report stated that the BEIR VII risk estimates “are numerically similar to risk estimates provided in BEIR V and in more recent UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation) and ICRP (International Commission of Non-Ionizing Radiation Protection) reports”, and “therefore, the NRC’s regulations continue to be adequately protective of public health and safety and the environment.” In addition, the BEIR VII Report concluded that there is no direct evidence of increased risk of non-cancer diseases in humans at low doses. In summary, the BEIR VII Report states that the conclusions of the study “contributes to refining earlier risk estimates, but none leads to a major change in the overall evaluation of the relationship between exposure to ionizing radiation and human health effects.”
- CERCLA Five Year Review, USDOE, Appendix B, Response to Comments on Five Year Review, Nov. 2006; Page B.4; Nov. 10, 2006.

USDOE Response to HoANW comments to 5 Year Review calling for revising cleanup levels and risk decisions based on BEIR VII:

- *Continued* Response to Comments on Five Year Review, Nov. 2006:
“DOE reviews to date indicate that it is generally consistent with the risk estimates in EPA’s Federal Guidance Report #13. Federal Guidance Report #13 is the basis for EPA’s cancer risk slope factors (Health Effects Assessment Summary Tables) used in DOE CERCLA risk assessments. When BEIR VII results are incorporated into applicable guidance such as EPA’s Federal Guidance Report #13 and the cancer risk slope factors, then DOE will incorporate such guidance for Hanford CERCLA radiation risk assessments.”
- CERCLA Five Year Review, USDOE, Appendix B, Response to Comments on Five Year Review, Nov. 2006; Page B.4; Nov. 10, 2006.

The Importance of Public Involvement and Input to Clean-Up Decisions

- State laws recognize - and require - input
 - MTCA (RCW Chapter 70.105D / WAC 173-340)
 - CPA (RCW 70.105E)
 - HWMA (RCW Chapter 70.105) (uses WAC 173-340)
 - CERCLA requires use of relevant state standards
- cleanups rely upon *exposure scenarios* and assumptions about future use and institutional controls, which are more likely to predict the future if they are the product of early public involvement.

Washington State's New Model for Public Involvement in Risk Assessment, and Notice to Future Site Users (including workers) of Residual Risks:

- Alternative reasonable maximum exposure scenarios require public input on current and future land and resource uses in order to determine if reasonably foreseeable uses will result in greater exposures than those proposed for the risk assessment. The Reasonable Maximum Exposure Scenarios are defined as:
- **“the highest exposure that is reasonably expected to occur under current and potential future site conditions considering.... the potential for institutional controls to fail...”** -WAC Sec. 173-340-708(3)(d)(i)

Greater Public Notice and Involvement required for Columbia River Corridor, National Monument in Setting Maximum Reasonable Exposure Scenarios:

- Current Uses of Reach include reasonable foreseeable exposures not stopped by a sign
- Native American Treaty Rights to live along and fish... Increases the maximum reasonable exposure scenario far above rural resident or resident ranger...
- MTCA risk assessment input assumptions are more protective than CERCLA (or USDOE's ResRad) and the standard for varying them is high.

Goal for Public Input to Maximum Reasonable Exposure Scenarios

- Ultimately, the growing emphasis on notice and participation in risk assessment will result in broad based recognition of a worker and public right to know about the risks from remaining contamination – including the assumptions about behavior and site use that our generation made for future users of today's hazardous waste cleanup sites.

MTCA Has High Standard Before Use of Institutional Controls, inc. Caps

- Recognizes they will fail
- MTCA has stronger standard than CERCLA requiring use of permanent remedies to *maximum* extent practicable. RCW 70.105D.030(1)(b):
- “In conducting, providing for, or requiring remedial action, the department shall give preference to permanent solutions to the maximum extent practicable and shall provide for or require adequate monitoring to ensure the effectiveness of the remedial action”
- Caps are recognized as not being preferred permanent remedy versus removal and treatment.

What Does the Future Hold for Hanford's Groundwater and the Columbia River?

- US sought to declare groundwater “*irreversibly and irretrievably committed*” to contamination in EIS, 2004. WA sued. EIS being reissued in 2008. Will it use credible model, actual contamination?
- Will renegotiation of the TPA include:
 - Goal and schedules to actually cleanup groundwater? Restore to beneficial use along River by 2018?
 - Bar adding more waste before cleanup?

Potential Projects / Internships

Directed Research

- Petition to US EPA to revise radiation cancer risk cleanup standards under Superfund based on BEIR VII data (National Academy, 2005)
- Petition WA Ecology to adopt cancer risk exposure model for calculating radiation exposure and risk to use in cleanup decisions under MTCA
- Petition review of Health Dept rule allowing import and burial in unlined trenches of large amounts of radioactive NARM, or to Ecology to regulate disposal as hazardous waste
- Review EIS in 2008 re groundwater modeling and contaminant spread.