

Hanford Site Cleanup: Progress & Challenges



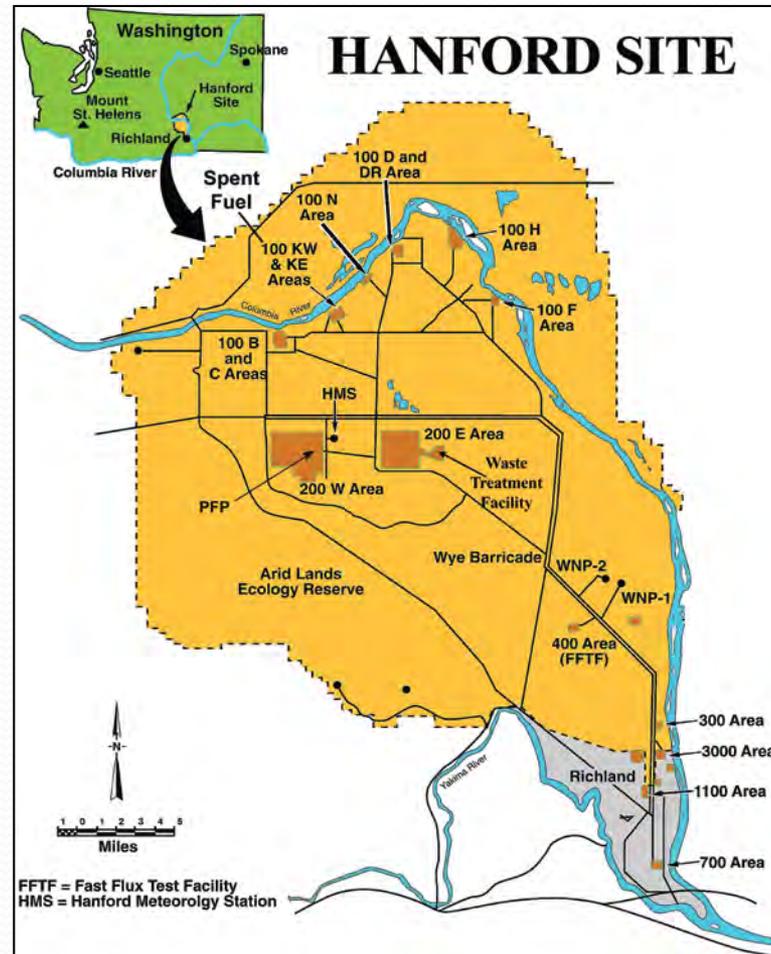
‘The Landscape of Irony’

“This has to be one of the strangest places on earth. The number of contradictions forced to exist together here — the Tri-Cities, the Hanford Site, the Horse Heaven Hills, the Columbia Basin — just boggles the mind ...”

- The Stranger, April 22, 2010



Can you
find
Hanford on
a map?



Reactors



**Plutonium
Processing**



**Fuel
Fabrication**

Ecology Office

Hanford High School

Richland "Village" 5 miles south

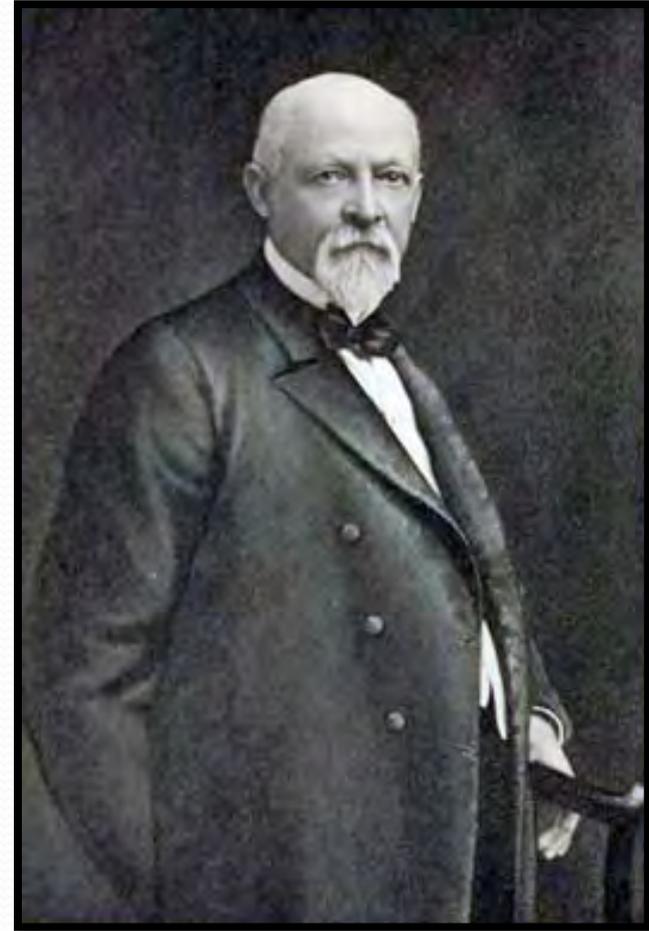


What's in a Name?

Where does the name
“Hanford” come from?

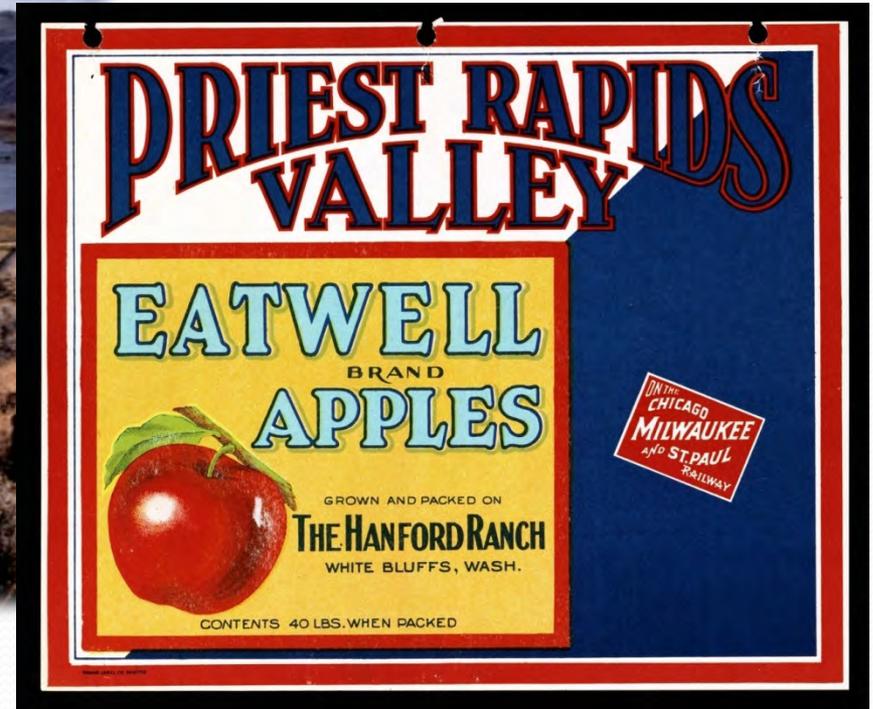
Answer: Hanford was a town
before it was a nuclear site.
The town was named for
Judge Cornelius H. Hanford.

He resigned during an
impeachment investigation after he
revoked a Socialist's naturalization.



Hanford Pre-1942

Hanford boasted
many apple orchards
by the 1940s.



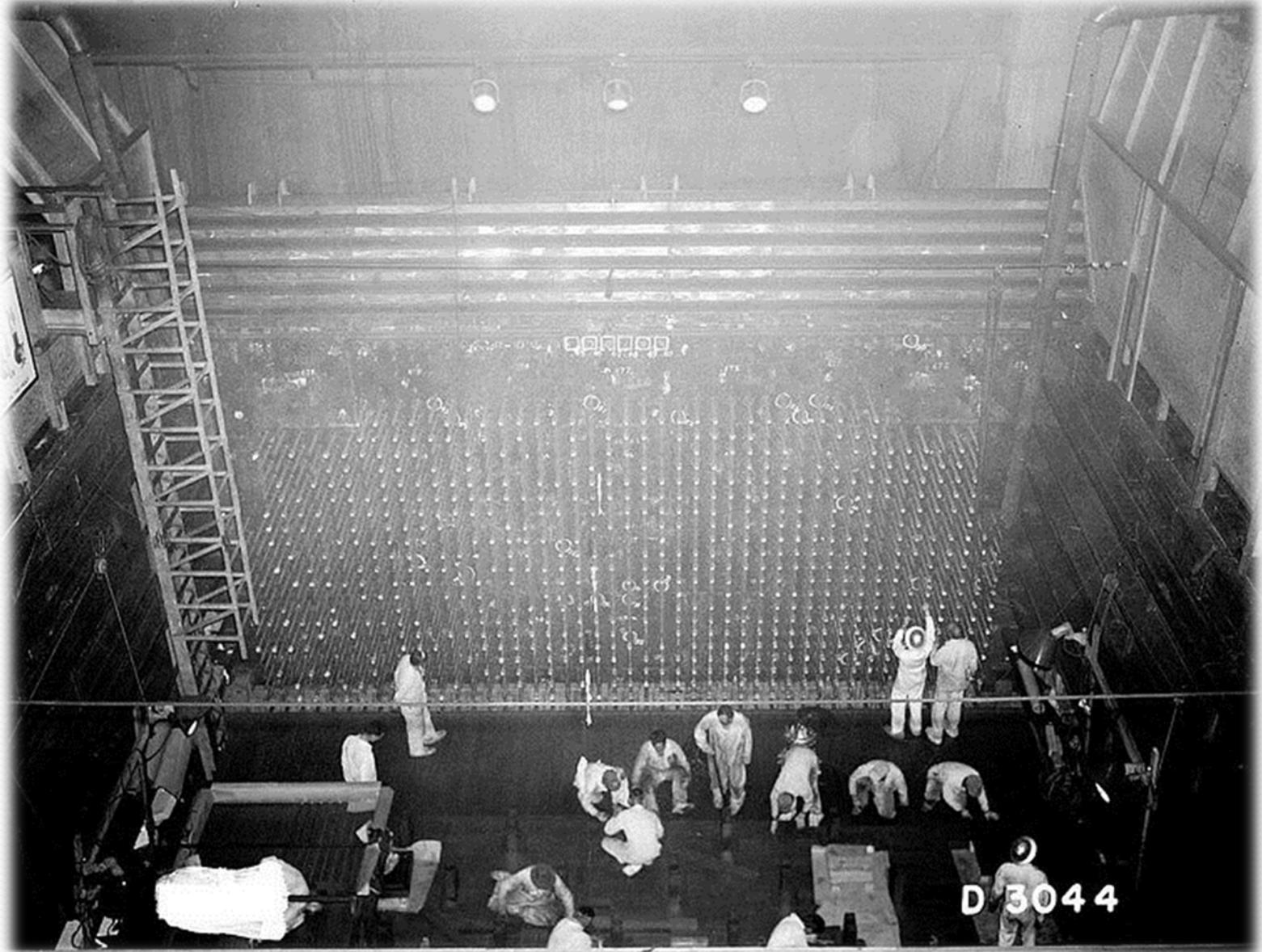
Yakama, Wanapum, Nez Perce, and
the Confederated Tribes of the
Umatilla Indians have all lived at
Hanford.

Building Hanford: 1940s

- The Manhattan Project has been called one of the largest public works projects in history
- The estimated cost of operating the nuclear weapons production complex from 1943 to the present exceeds \$4 trillion

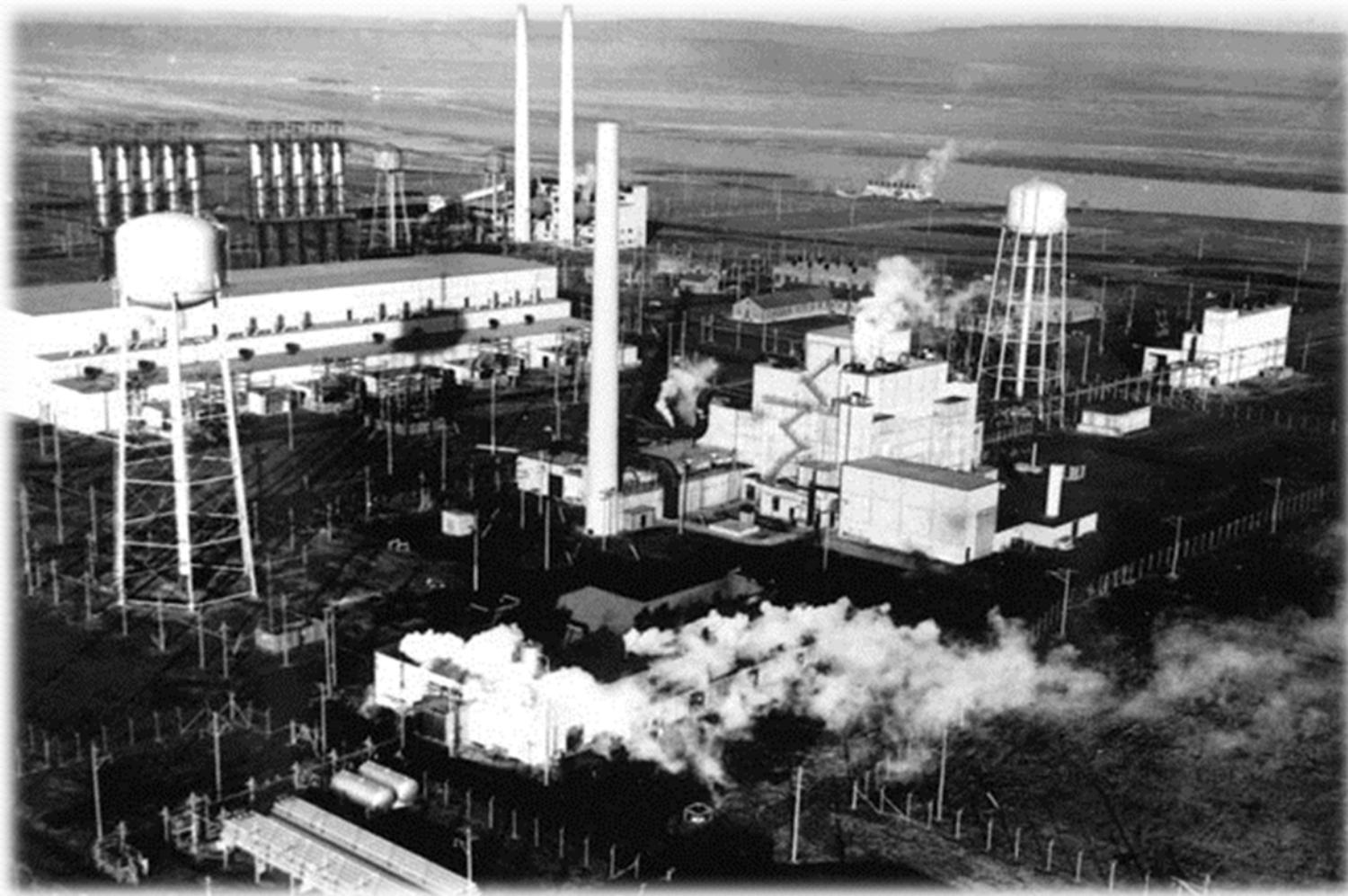




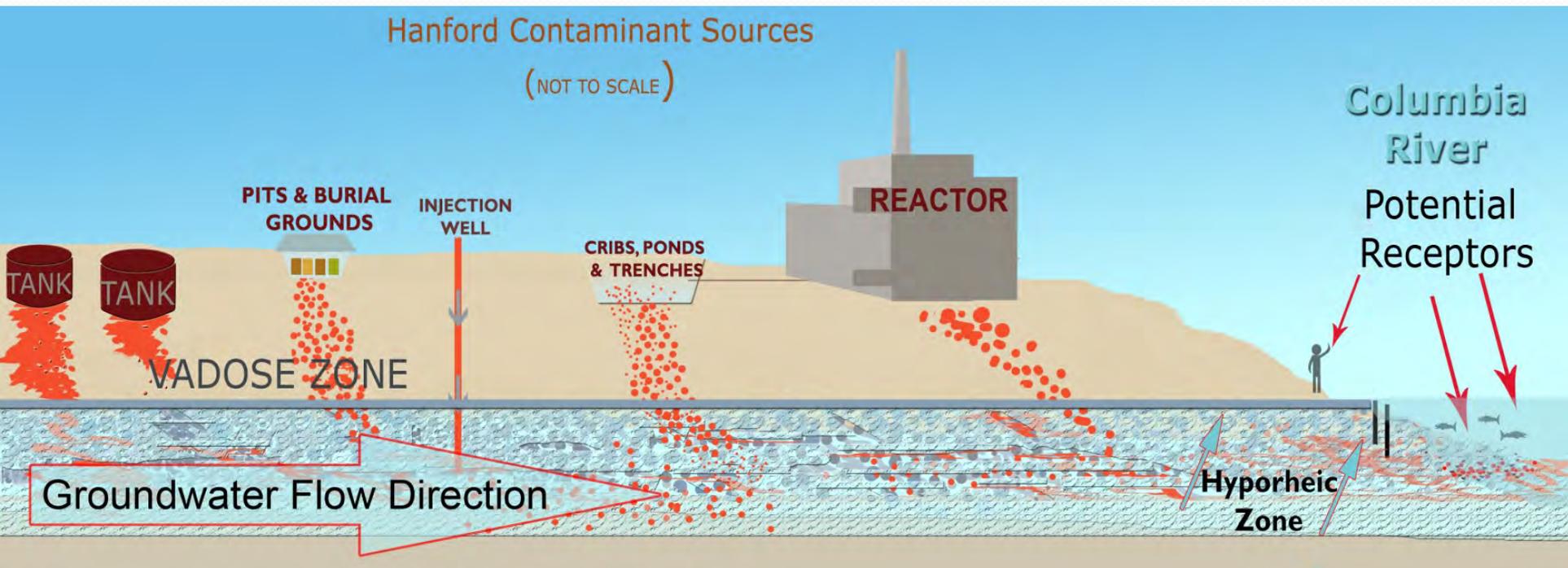


Production: 1945-1988

- Nine plutonium production reactors were built at Hanford
- Hanford made about 65% (74 tons) of the nation's plutonium for nuclear weapons



Hanford Contamination Sources



How Much Tank Waste Was Discharged to the Ground?

- About 122 million gallons
- Between 1946 and 1958
- Making space for newly-made waste
- More than 60,000 Curies
- More than 275,000 tons of chemicals

Critical Cleanup Issues

- Clean groundwater to protect Columbia River
- Retrieve tank waste
- Build and run Waste Treatment Plant
- Remove contaminated soil from river shore
- Complete Plutonium Finishing Plant demolition



From Creation to Cleanup

What did Hanford's manager hand out when the Tri-Party Agreement was first signed in 1989?

Answer: Ex-Hanford manager Mike Lawrence (second from right) gave the TPA signers brooms to symbolize cleanup.



Legal Cleanup Begins: 1990s



Cleanup Continues Today...



Waste Treatment Plant under construction

Cleanup Challenges

~65 square miles of
contaminated groundwater

~43 linear miles of unlined
solid waste landfills

2,400 waste
management
units/areas of
concern



56 million
gallons of waste
in 177
underground
tanks



Contaminated soil and
buildings



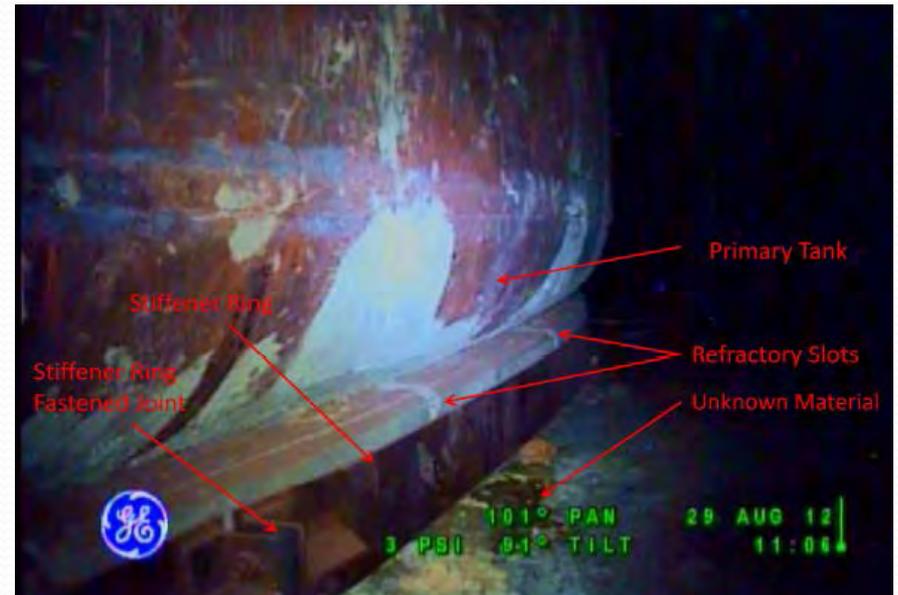
How is Cleanup Work Done?

- US Department of Energy (USDOE) plans the work
 - Regulatory agencies approve plans
- USDOE does work per work plans
 - Regulatory agencies oversee work
- USDOE reports work
 - Regulatory agencies check report, modify recommendations, and may request further work
- All regulations have same goal: to protect human health & environment



Recent Tank Issues

- Double-shell tank is leaking between shells (annulus), and possibly to the environment.
- The State believes USDOE should begin pumping waste from the leaking double-shell tank very soon.
- State and stakeholders are asking for new tanks.



Want to Know More About Hanford?

Get informed!
Stay informed!
Inform others!



- www.ecy.wa.gov/programs/nwp
- www.Hanford.gov
- Hanford stakeholder groups



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Get the latest news & information about Hanford cleanup and related issues from @EcologyWA Nuclear Waste Program
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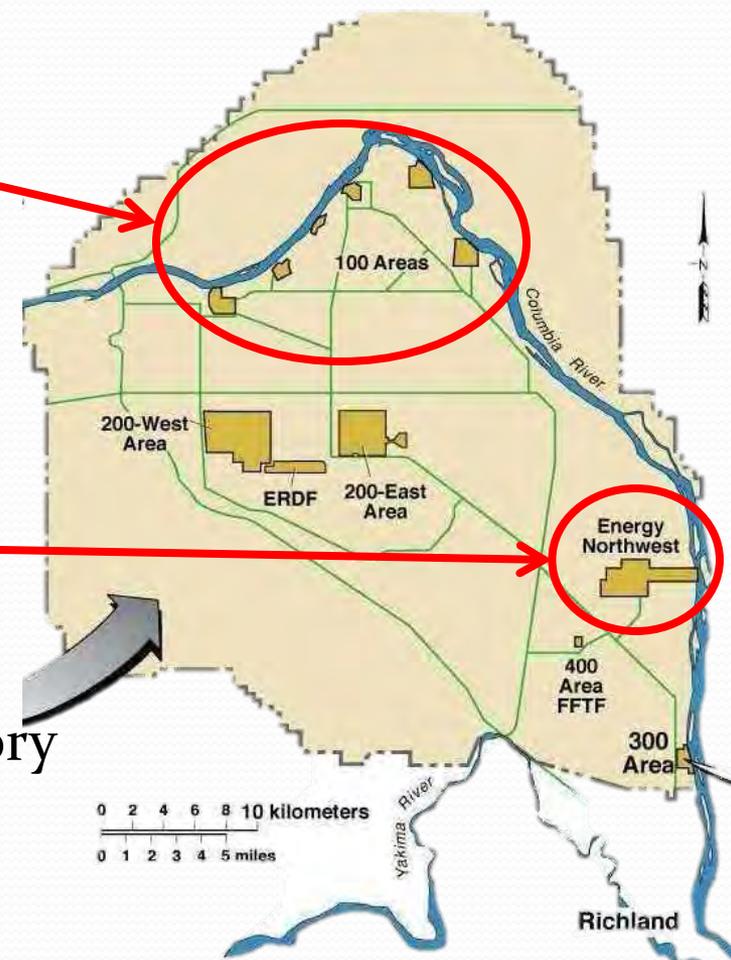


Ecology's Hanford Outreach Team



Reactors Past & Present: What's the Difference?

- Hanford's 9 original reactors produced plutonium, not energy
 - All these reactors are shut down and are part of cleanup efforts
- WA State's only nuclear power plant operates on Hanford land
 - Waste storage at this facility is not subject to state regulations
 - Regulated by NRC (Nuclear Regulatory Commission) not Ecology
 - Not owned by US Department of Energy



Where Does Hanford Waste Go?

- Deep geologic repository
 - High-level vitrified waste (10%)
- Waste Isolation Pilot Plant (NM)
 - Transuranic waste (not tank waste)
- Waste to stay at Hanford landfills
 - Low-activity vitrified waste (90%)
 - Contaminated soil
 - Debris from demolished buildings
 - Any other low-level waste



Yucca Mountain, Nevada

What's the risk?

- No immediate risk to the general public
 - Hanford is secure site (no public access)
 - Groundwater mostly contained – for now
- State's mission is protecting river for future use
 - Contamination could impact river if nothing done
- Hazardous materials being handled (radioactive/chemical)
 - Work must be done safely to avoid exposure
- State concerned about retrieval & treatment of tank waste
 - Tanks have leaked in past; some are leaking now
 - Feds obligated to meet legal deadlines for cleanup



Hanford in the headlines



争议中的汉福德核污染

切尔诺贝利的辐射阴影还未散去, 美国汉福德地区的核工厂又传来放射性污染的消息。在当地捉到一只被放射性元素“铯”高度污染的兔子后, “食人巨鼠”的传言接着甚嚣尘上。不过, 汉福德地区核污染处理部门主任迪特·伯尔曼告诉《周末画报》, 传闻中的“食人巨鼠”, 其实只是人们的想象而已。

■ 采访: 原文记者整理

- Modern Weekly, Shanghai



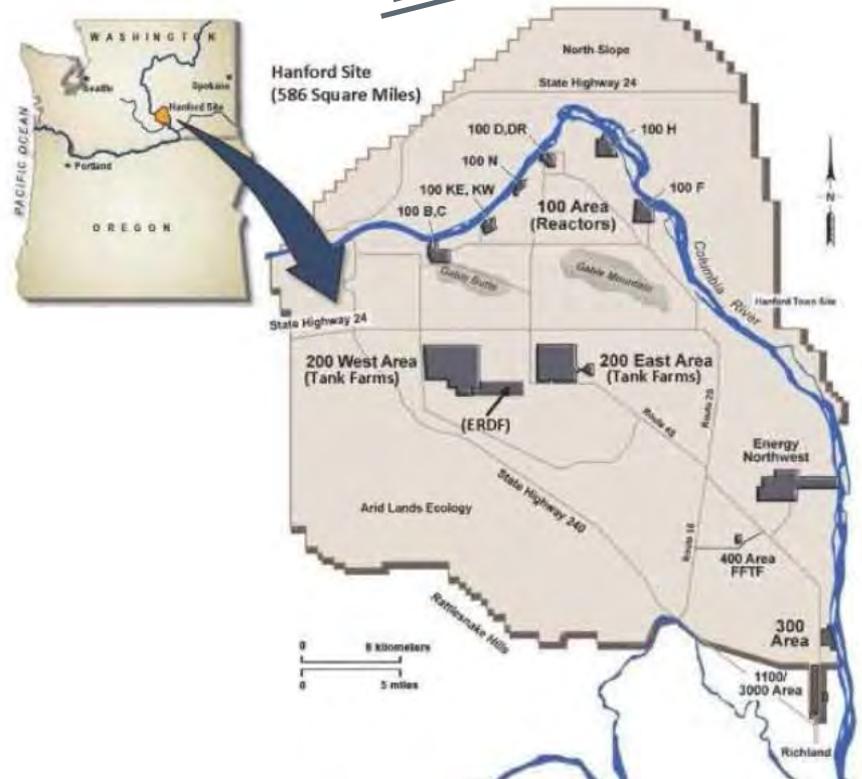
25 years on at America's most contaminated nuclear waste site

Hanford

From The Highway



Audio Driving Tour



Tank Waste Treatment

Policy issues

- 2010: Treatment start date delayed 8 years, after 3 false starts and 2 delays in the current plan, resulting in **21 years total delay**
- Budget shortfalls
- More delays may occur

Technical issues

- Black cell design
- Erosion/corrosion
- Pulse jet mixers
- Particulate buildup
- Flammable gas



Final waste disposal

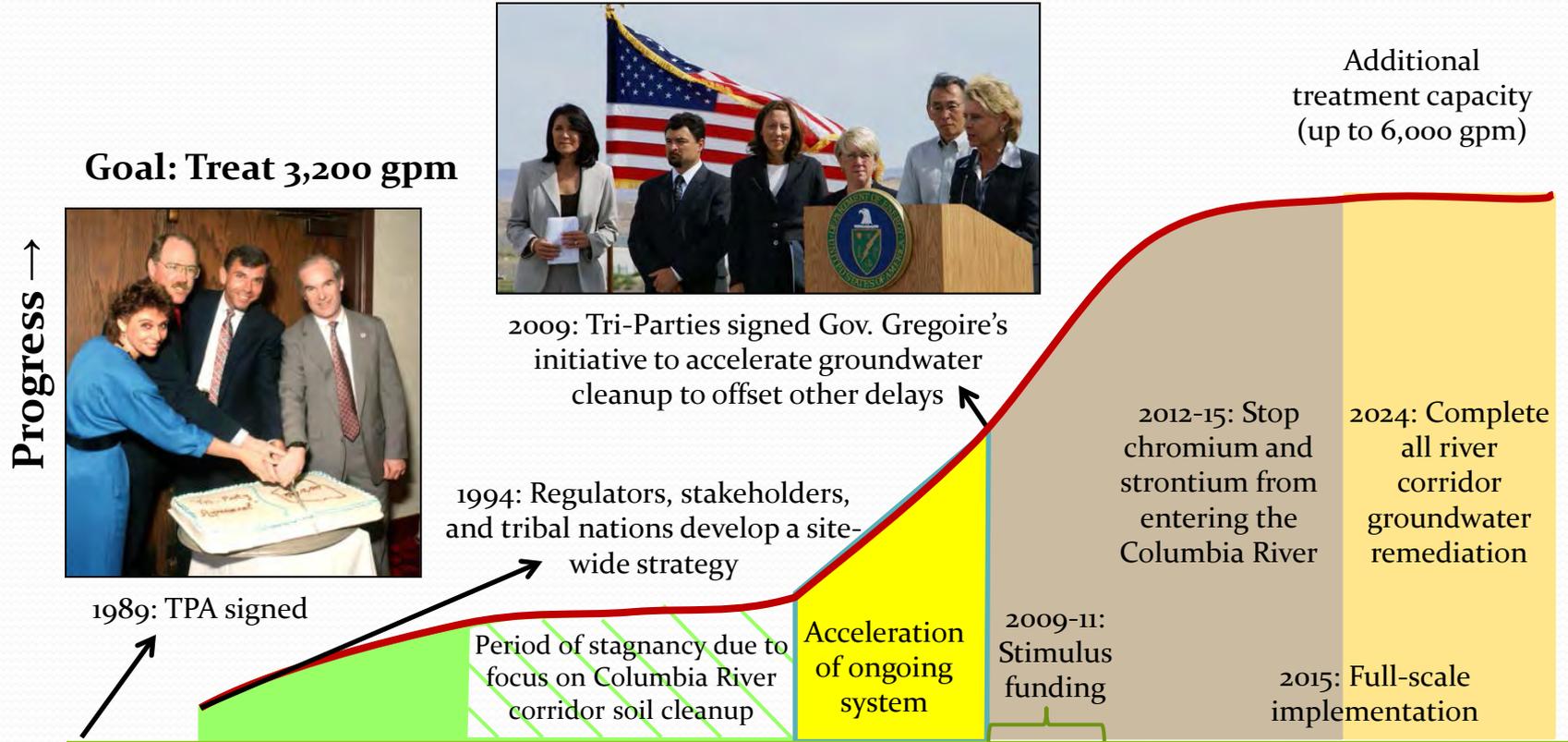
- Low-activity waste: Integrated Disposal Facility at Hanford
- High-level waste: Deep geologic repository

Protecting the Columbia River

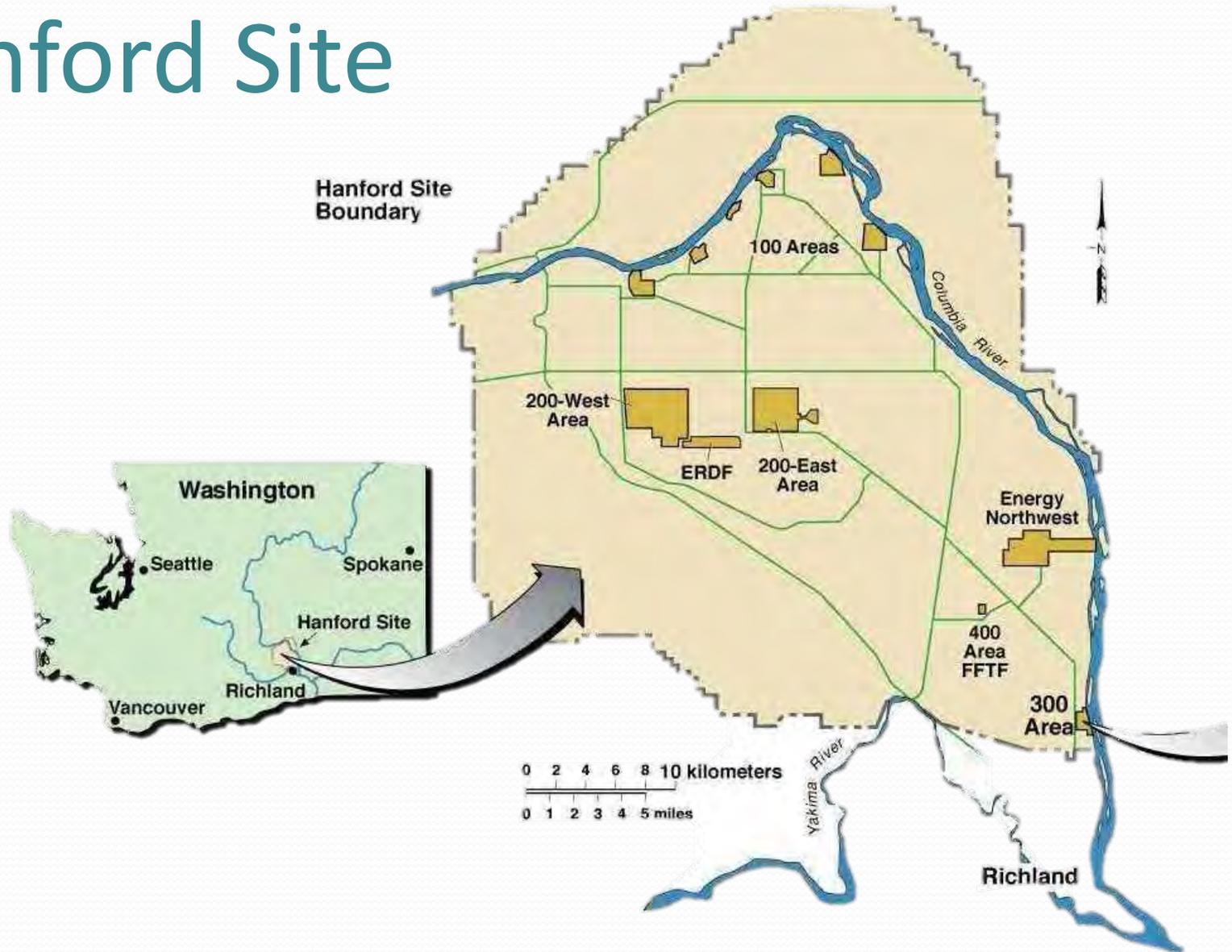
- Approximately 3,000 wells are in use; about 1,000 wells are sampled each year
- More than 300 aquifer tubes located along the Columbia River are sampled each year
- River pore water, sediment, and river water are sampled routinely
- Biota (plants and animals) are sampled routinely

Groundwater Remediation

Progress made over past 20+ years has been Tri-Party team effort



Hanford Site



Cleanup Oversight

- Tri-Party Agreement (1989) provides legal framework for how agencies work together on Hanford cleanup and schedules
- RCRA gives Washington authority to issue permit for:
 - Management of dangerous and mixed wastes
 - Cleanup of spills, leaks, and other contamination (non-radioactive)
- Ecology permit outlines conditions for treatment, storage, and disposal of chemically hazardous wastes

Former Governor Gregoire



- I'm the largest mammal at Hanford and I live in a herd on Rattlesnake Mountain.
- I eat grasses and leaves, bark and twigs.
- I can live in forests and open meadows.
- Men hunted me for my meat, skin, and bones.

WHO AM I?

Elk

Big
horn
sheep

Woolly
mammoth

Elk (*Cervus elaphus*)



Did you know? Lewis and Clark's expedition killed and ate at least 375 elk during their trip. A herd of elk is also called a gang.

- I'm a good hunter with a strong sense of smell and great vision.
- I eat nearly anything!
- I live across the American West, from deserts to cities... Just about anywhere!
- In the fall and winter, I hunt in packs.
- We form strong family groups.

WHO AM I?

White
Pelican

Coyote

Badger

Coyote (*Canis latrans*)



Coyotes are common in folk tales and native traditions because they are clever and adaptive.

Did you know? Coyotes are strong swimmers!

- My common name comes from mules (jackasses), which also have long ears.
- I have very long hind legs and ears. I am a powerful jumper and fast runner.
- I eat grasses and plants, including crops, which is why farmers hunt me.
- I live in open areas in the American West—from deserts to farms.

WHO AM I?

Road-
runner

Coyote

Jack-
rabbit

Black-Tailed Jackrabbit (*Lepus californicus*)

It's actually a hare, not a rabbit.

**Species of
Concern!
Populations are
shrinking with
habitat loss.**



Did you know? The jackrabbit's long ears help it scoop in sound so it can be alert for predators. Their ears also help them shed heat.

- Sometimes I invade houses, especially in the countryside.
- I am not a good climber, so I'm usually near the ground.
- I'm about 3-4 inches long, with a 2 to 5-inch tail.
- I eat seeds, insects and spiders, leaves, and fruit.
- I live in woodlands, fields, and grasslands. I like dry areas.
- I'm nocturnal (active at night).

WHO AM I?

Ground
Squirrel

Deer
Mouse

Raccoon

Deer Mouse

(*Peromyscus maniculatus*)



Did you know? A baby deer mouse is called a pinkie, a kitten, or a pup. A group of deer mice is called a nest, colony, horde, or a mischief!

- I'm in the weasel family, but I'm much larger than a weasel. People think I'm vicious.
- My jaw can lock onto prey very tightly.
- I eat small burrowing animals like mice and gophers.
- I catch most of my food by digging with my long curved claws and short, powerful legs.
- I live in underground burrows—open areas, farms, edges of woods.

WHO AM I?

Weasel

Badger

Raccoon

Badger (*Taxidea taxus*)



Did you know? Badgers have been known to get drunk by eating rotting fruit! It is the state animal of Wisconsin.

- Despite folk tales, I will not cause warts!
- I am a small, rather chubby amphibian, gray or olive green, with very large, golden yellow eyes. I have a spike on my ankle to help me dig.
- I eat insects and small critters. I like to forage at night.
- I live in dry grasslands and open woodlands. I need loose soil for burrowing for shelter or to find food.

WHO AM I?

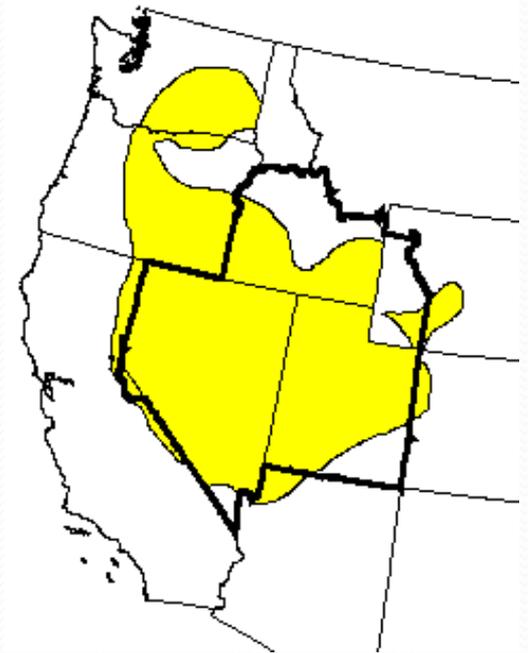
Bullfrog

Horned
Toad

Great
Basin
Spadefoot
Toad

Great Basin Spadefoot Toad

(*Spea intermontana*)



Did You Know? The Great Basin Spadefoot Toad only goes to water to breed. A small black spade on the first toe of each hind foot helps it to dig in loose soil.

- I waddle on land, but in water I am quite graceful.
- I use my large tail as a rudder.
- I eat leaves, twigs, aquatic plants, and roots.
- I especially like willows and cottonwoods, which grow at Hanford.
- I'm one of the largest rodents! I may weigh up to 60 pounds. I live up to 24 years.
- I live in rivers, streams, ponds, and marshes. Along the Columbia River, I burrow into the banks.

WHO AM I?

Mink

Beaver

Penguin

Beaver

(*Castor Canadensis*)



Did you know? The entrance to a beaver lodge is usually under water.

- I am small, quick, and quite handsome!
- I eat flying insects. I drink by skimming the surface of a river or lake and scooping water into my lower mandible (beak).
- I live across much of North America, near canyons, slopes, river shores, and rivers.
- I spend most of my waking hours on the wing. In the fall, I migrate to South America.

WHO AM I?

Long-
nosed
Bat

Seagull

Bank
swallow

Bank Swallow (*Riparia riparia*)

(loosely translated as “Rivershore Rivershore”!)



Did you know? The Hanford Reach has a huge nest colony—about 10,000 nesting pairs—believed to be the largest in North America!

- I am a voracious eater, and will eat anything I can overpower and stuff down my throat!
- Though I usually eat small fish, insects, and other invertebrates, I also eat turtles, ducklings... even a bat once! I am not native to this area, though I have invaded.
- I live along the water's edge in rivers, swamps, lakes, and ponds.
- I'm the largest amphibian in North America—3 to 6 inches long, sometimes longer. My legs add another 7 to 10 inches!

WHO AM I?

Gully-
whomper

Bullfrog

Eastern
Tree
Frog

Bullfrog (*Rana catesbeiana*)



Tadpole!

**Bullfrogs
are NOT
native!**



Did You Know? Bullfrogs were introduced to the American West as a food source. Frog legs were cheap and popular in the late 1800s. One reason bullfrogs are so common is that fish don't like the flavor of bullfrog tadpoles, so many survive to adulthood!

- I am a predatory songbird!
- I mainly eat large insects such as grasshoppers and crickets. I'll also eat lizards, mice, and small birds.
- I use my hooked beak to kill my food. Then I stick it on thorns or barbed wire for storage, so I can tear it apart and eat it later.
- I live along river shores and in shrubs in open country.
- I'm listed as critically endangered in Canada.

WHO AM I?

Logger-
head
Shrike

American
Crow

Southern
Lapwing



Loggerhead Shrike

(Lanius ludovicianus)

Did you know? I'm also called the butcher bird! I often perch on posts or fences.

- I am a hardy, all-season bird of open areas.
- I eat mostly seeds and grain, and insects in the summer.
- I live throughout the US and Canada, except the Southeast.
- I live in grasslands and mountains. I am abundant on the Hanford Reach yearlong. I also like it on Badger Mountain and you can hear me there.
- I am the only true lark native to the New World. As one of the earliest nesting birds, I can raise as many as three broods each year.

WHO AM I?

Western
Meadow
Lark

Horned
Lark

Horned
Grebe

Horned Lark (*Eremophila alpestris*)



Did you know? Like salmon, the horned lark is philopatric, or faithful to its birthplace, where it returns after every migration. In fact, each local population adapts to the color of its habitat. There are 15 distinct subspecies in the West!

- I have very formal rituals to attract a mate, and I'm the largest grouse in North America.
- I eat sagebrush plants and some insects, also weeds and grasses.
- I live in Western states, in open sagebrush plains. But I no longer live in British Columbia, Kansas, Nebraska, Oklahoma, Arizona, or New Mexico.
- I'm endangered because I depend so much on sagebrush, even though many people think it's just "empty desert."

WHO AM I?

Sage
Sparrow

Sage
Thrasher

Sage
Grouse



State Threatened
Species!
Federal Species of
Concern!
Numbers are shrinking
with habitat loss.

Sage Grouse

(Centrocercus urophasianus)

Did you know? During mating season, males gather on a “lek” or a special open display area. They strut around and display their plumage to attract a mate.

- People love to fish for me. Native Americans have eaten me for centuries, and lots of other people eat me too!
- I build my nest in river rocks, cleaning first with my tail, then laying as many as 3000 eggs. My nest is called a redd, and may be as big as a Volkswagen Beetle!
- I spend four to seven years in the ocean before coming home to spawn, and I build my redd within meters of where I was hatched.

WHO AM I?

Wide-
Mouth
Bass

Chinook
Salmon

Rainbow
Trout



State Candidate
Species!
Federal Threatened
Species!
Numbers are
shrinking with
habitat loss.

Chinook Salmon

(*Oncorhynchus tshawytscha*)

Did you know? The Hanford Reach has the largest remaining spawning grounds in the Columbia River system. Salmon avoid the chromium contamination from Hanford and won't build their redds near those spots. (Smart fish!) Chromium is harmful to developing salmon eggs.

- I nest in burrows, often dug by mammals (including humans).
- My populations are declining in most areas. You can watch my nest on the state's owl cam!
- I eat mainly insects, also small mammals, lizards, frogs, and snakes.
- I live in grasslands, shrubs, and open country.
- I also nest in golf courses, college campuses, vacant lots, cemeteries, airports, and prairie dog towns.

WHO AM I?

Cliff
Swallow

Badger

Burrowing
Owl

Burrowing owl

(*Athene cunicularia*)



Did You Know? The Latin, or scientific, name comes from Athena, the Greek goddess of wisdom whose mascot was the owl.

You can watch the owls on the state's owl cam! (Search "Burrowing Owl Cam")

- In Nez Perce tales, I rescued maidens who fell out of their boats!
- I have been around since the time of the dinosaurs. I can grow to 14 feet long and can weigh almost a ton.
- People like to eat my eggs. I lay between 100,000 and 300,000 eggs, but only once every 5 or 10 years.
- Since I can live more than a century, my body can pick up lots of toxins from what I've eaten over my many years of life.

WHO AM I?

White
Sturgeon

Steelhead
Trout

Chinook
Salmon



White Sturgeon

(Acipenser transmontanus)

Did You Know? I used to migrate like salmon and steelhead. But because I'm so big, I can't use fish ladders or get past the dams. My cousins below Bonneville Dam do still migrate to the ocean.

- I'm a bird of prey and I have an amazing migration pattern. I fly between grassy areas in Argentina in South America to the American West and even Canada, twice a year!
- During breeding season, I eat mice, snakes, squirrels, rabbits, and even other birds. The rest of the year, I eat mostly grasshoppers and dragonflies.
- I have lots of different color schemes in my plumage.
- When I fly, my wings form a shallow "V".

WHO AM I?

Red-
Tailed
Hawk

Swainson's
Hawk

Bald
Eagle

Swainson's Hawk

(Buteo swainsoni)



Did You Know? Migrating flocks number into the thousands. But numbers are declining because of pesticide use, especially in South America.

- My name comes from my big ears. My tail is black-tipped, and my antlers are forked rather than branching from a main beam.
- I eat leaves and berries. I also eat fresh grass.
- I'm pretty big. I stand 40-42 inches tall at the shoulders and am about 80 inches long. I can weigh up to 300 pounds!
- I live everywhere across the American West.
- People like to hunt me.

WHO AM I?

Mule
Deer

White-
Tailed
Deer

Jackalope

Mule Deer

(Odocoileus hemionus)



Did You Know? Mule deer are most active in the early morning and evening. In mid-day, they bed down near their food or water sources. Sometimes they forage for food at night when the moon is full!

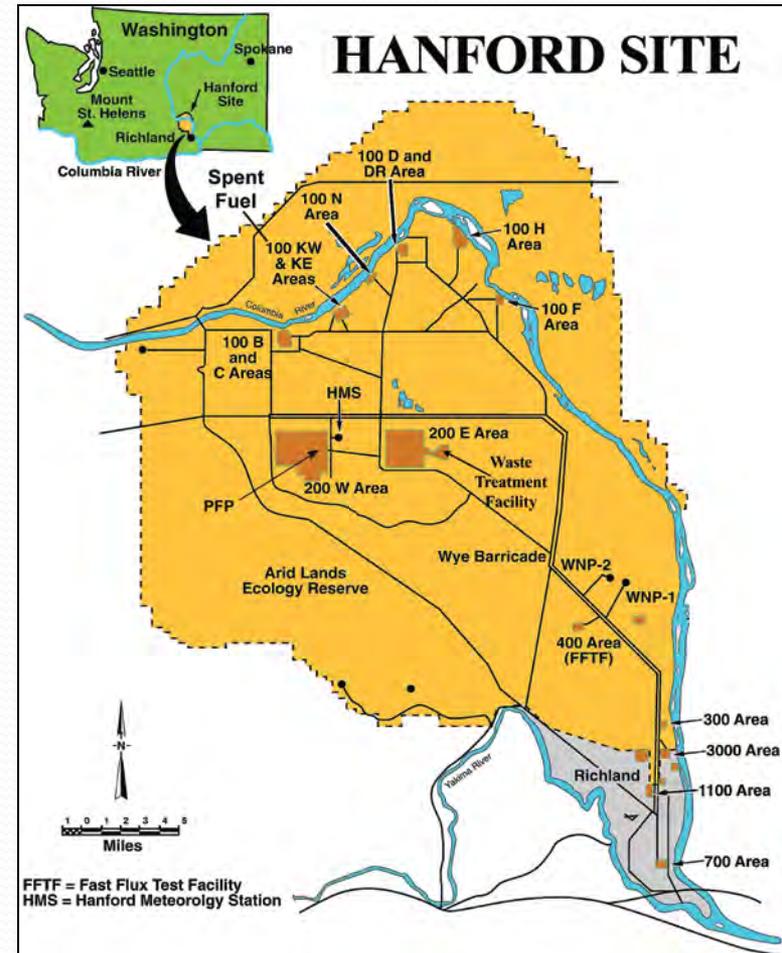
Hanford Fast Facts

- Home to the world's first plutonium-production facilities
- Built during WWII as part of The Manhattan Project
- Employed 50,000 at peak of production in 1940s
- Created plutonium for the bomb dropped on Nagasaki
- Operated during Cold War
- 586 square miles
- Current employment for cleanup project: ~10,000



Why Hanford?

- Wide open spaces offered buffer zone for defense
- Lightly populated
- Access to lots of water to cool reactors
- Grand Coulee Dam provided reliable power
- Railway to deliver supplies and equipment



How is Cleanup Work Done?

- USDOE plans the work
 - Regulatory agencies approve plans
- USDOE does the work per work plans
 - Regulatory agencies oversee work
- USDOE reports work
 - Regulatory agencies check report, modify recommendations, and may request further work
- All regulations have the same goal: to protect human health & environment



Cleanup Challenges

- Federal budget
 - Lifecycle cleanup cost = \$114B
 - What is the risk reduction per dollar spent?
 - How does Hanford rank vs. other priorities?
- Tribal treaty obligations (3 tribes)
- Natural resource damage assessment
- Why is it taking so long? (70+ years)
- Communicating highly technical issues and difficult choices to public



Cleanup Accomplishments

- Stopped liquid discharges to soil
- 15 million tons of contaminated soil removed from river shoreline
- 20 years worth of groundwater pumped and treated to protect Columbia River
- 6 of 9 reactors cocooned; 1 preserved as national landmark
- Most pumpable liquids removed from 149 single-shell tanks
- Records, soil, & water sampling have better defined the problems we face – we now have a plan



What's the risk?

- No immediate risk to the general public
 - Hanford is secure site (no public access)
 - Groundwater mostly contained – for now
- State's mission is protecting river for future use
 - Contamination could impact river if nothing done
- Hazardous materials being handled (radioactive/chemical)
 - Work must be done safely to avoid exposure
- State concerned about retrieval & treatment of tank waste
 - Tanks have leaked in past; some are leaking now
 - Feds obligated to meet legal deadlines for cleanup



The Paradox of Hanford

- Reputation as 'most contaminated site in western hemisphere'
- Leaky tanks are potential threat to people, environment
- Many people fearful & angry about Hanford



- Hundreds of square miles untouched for 70 years
- Hanford Reach home to healthy populations of plants, animals, fish
- Jobs created vibrant community

Want to Know More About Hanford?

Get informed!
Stay informed!
Inform others!



- www.ecy.wa.gov/programs/nwp
- www.Hanford.gov
- Hanford stakeholder groups

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Dieter Bohrmann
[@ecyhanford](https://twitter.com/@ecyhanford)

Communication manager for Ecology's Nuclear Waste Program overseeing Hanford cleanup. You can also find us on Facebook at facebook.com/hanfordeducati...

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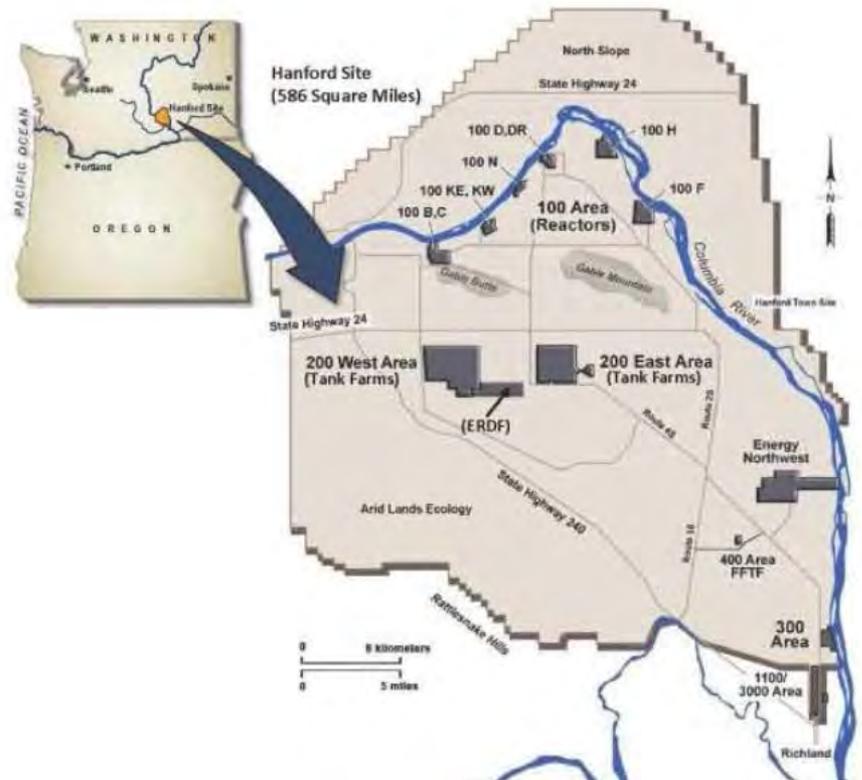
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Hanford

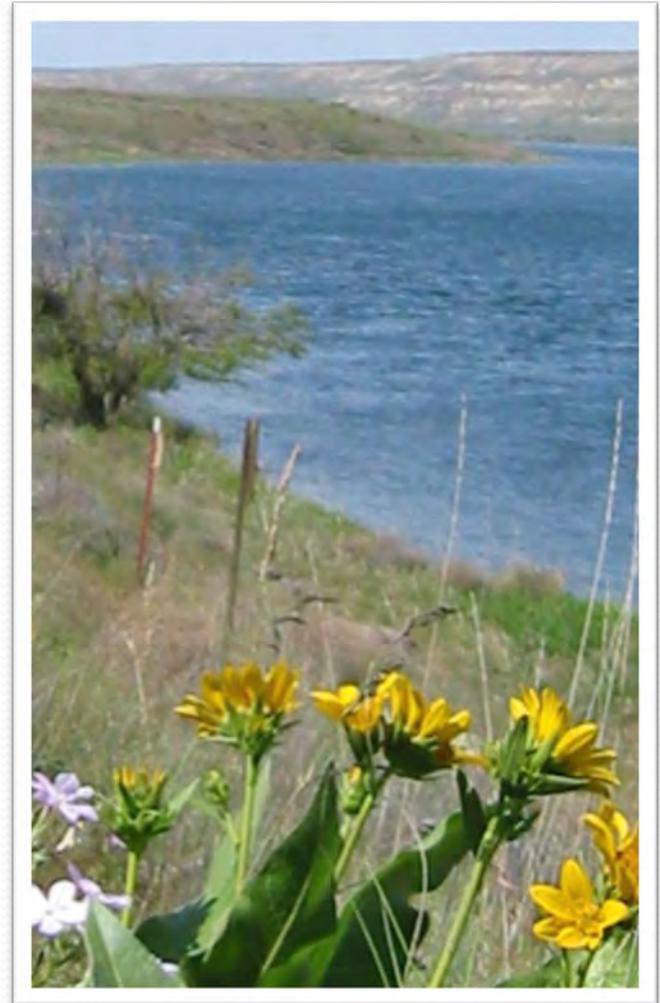
From The Highway

Audio Driving Tour



Ecology's Role at Hanford

- Ensure that Hanford cleanup protects the Columbia River by following state laws to protect our air, land, and water
- Protect, preserve, and enhance the state's environment



Public Involvement Opportunities

Public Comment Periods



It's the law!

How Public Opinion Affects Decisions

Federal and state legislatures pass environmental laws intended to protect people and the environment

Government agencies (such as Ecology) write regulations to implement environmental laws

Regulations require programs, plans, studies, reports, and permits

Regulations require **public comment periods** and/or **hearings** on those plans, studies, etc., or agency policies encourage public participation

What's a Public Meeting?

What's a Public Hearing?

- **A public meeting** is intended to provide information to the public, typically during a public comment period for a draft proposal, prior to the responsible agency making a final decision
- **A public hearing** is intended to collect public comments that the responsible agency must respond to in writing

What's the Value of Your Opinion?

“Intent. Public involvement and participation play a significant role in the decision-making process.

- The department [of Ecology] intends to foster public awareness, information, and consultation, and to respond actively to public concerns.
- The department will inform the public of major issues, proposed projects, and regulatory changes, and will consult interested and affected segments of the public before making important decisions.”

Washington Administrative Code 173-303-900, Public involvement and participation, Dangerous Waste Regulations.

What's the Impact of Your Opinion?

- Before a public forum, Ecology prepares to answer questions we hear often
- Public feedback on our answers causes Ecology to reconsider and modify our positions
- Ecology shares public feedback with US Department of Energy and the Environmental Protection Agency



Some Challenges to Formulating and Expressing Your Concerns About Hanford...

- Costs prohibit developing complete data
- Limits on scientific understanding
- Difficulty of predicting risks and outcomes
- Technologies may be unproven
- Technical jargon
- Complex proposals



The challenge of **massive** amounts of information



Ecology's permit for the treatment, storage, and disposal of dangerous waste at Hanford is almost **16,000 pages!**

Traditional Comment Process

- Get a copy of a document as early as possible in a 30-day (sometimes longer) public comment period
- Read the document
- Draft your comments
- Send your comments to agency
- Read a response to your comments



Better Comment Process

- Find contacts at government agencies before public comment periods start
- Comment early and often
- Team up with a public interest group and coordinate your comments



Seattle's Raging Grannies!

Adapted from *The Art of Commenting: How to Influence Environmental Decisionmaking with Effective Comments*, Mullin, 2000.

More Effective Comments

- Identify your objectives for a proposal
 - Support a particular outcome
 - Stop, delay, or minimize an action's impacts
- Frame your comments to support your specific objectives



Adapted from *The Art of Commenting: How to Influence Environmental Decisionmaking with Effective Comments*, Mullin, 2000.

Choices for Affecting Hanford Cleanup

- Contact Federal or State government elected officials, or government agency representatives
 - Communicate your values related to Hanford cleanup
- Attend a public meeting or hearing
 - Submit verbal or written comments on a specific, proposed decision about Hanford cleanup



Commenting (advocating) Outside Comment Periods

- Website contact forms
- Twitter
- Facebook
- Petitions
- Letters

United States Senator
Patty Murray
Working for Washington State

Home About Patty Services Newsroom Issues Legislation

Contact Me

Contact Me

Contact Form

Note: Fields marked with an * are required.

If you are in the Military and stationed outside of WA State, please select 'Military Personnel' in the list of topics below and fill out the form with your WA State address and include your Military address in the body of the text area.

If you need help with an immigration issue, veteran benefits, social security benefits, etc. or a government agency (INS, VA, SSA), please go to our [Privacy Release Form](#). **NOTE** - because of the Privacy Act of 1974, my office must have a written request with a signature in order to assist constituents with difficulties they are experiencing with a federal agency. A federal agency cannot provide my office information about a case without this written authorization. See our [Privacy Release Form](#) or send a detailed statement with your signature via mail or fax to my office.

To discuss your case with someone on my staff, please contact the office nearest you: Seattle, Spokane, Vancouver (Please do not send your request to my Washington, D.C. office as it will delay the response to your request)

If you are coming to DC and would like to request a tour, please see our [tours page](#).

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People *Can* Make a Difference

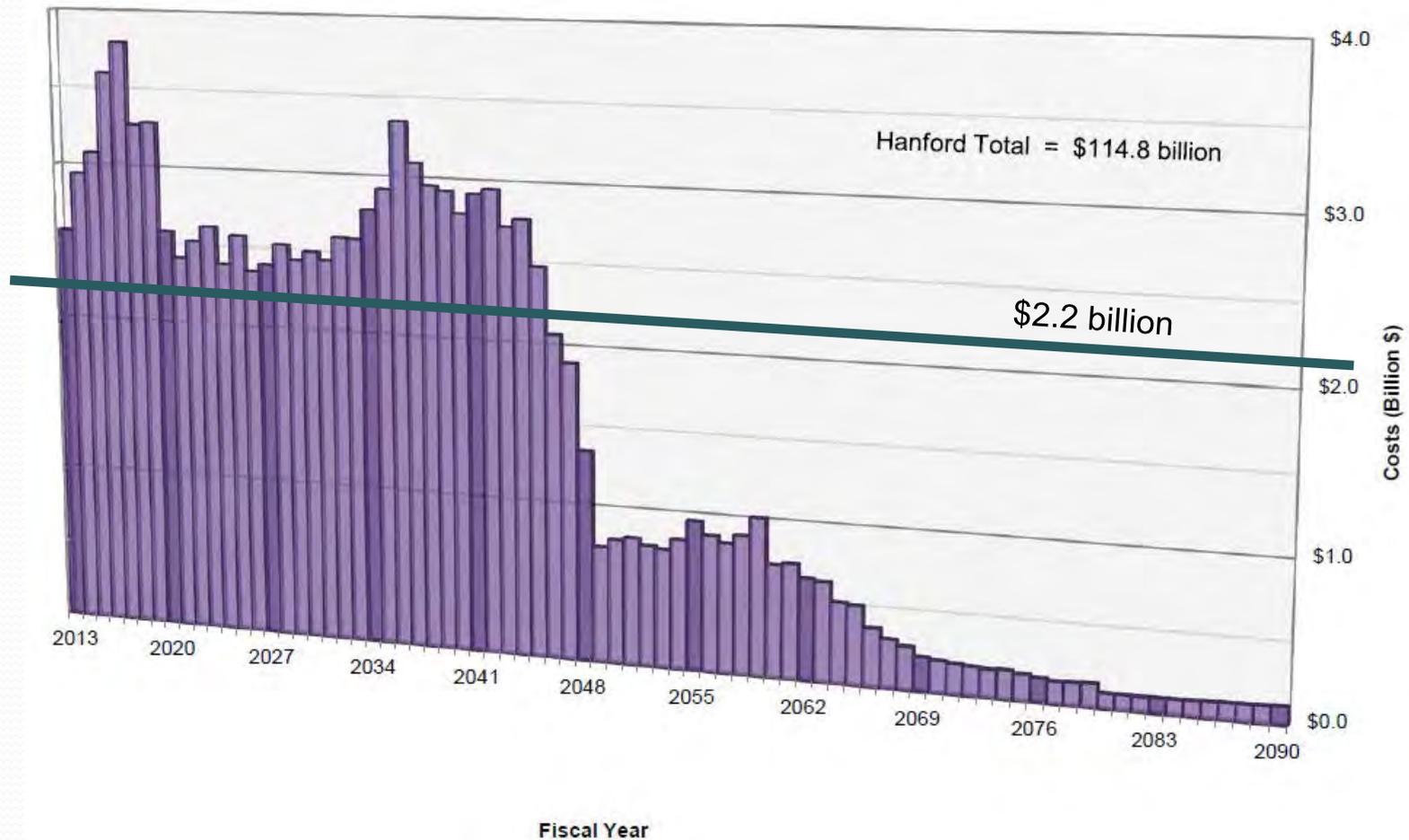
Ask leaders how they achieved success!

- Team up with them
- Copy their strategies and tactics
- Develop strategies and tactics you're comfortable with



Hanford Advisory Board, September 2013

Hanford Lifecycle Costs



Some Current Hanford Issues

- Federal budget limits
- Leaking single-shell tanks
- Building new double-shell tanks
- No designated national disposal site identified for high-level waste
- River Corridor final cleanup decisions



B Tank Farm under construction during World War II.

More Info Available Online

Nuclear Waste website:
ecy.wa.gov/programs/nwp

 **Blogger**

ECOconnect

ecologywa.blogspot.com



In this double issue

- 1 Potential wear & tear in WTP piping, tanks causes concern
- 2 Erosion & corrosion at WTP: A timeline
- 3 Low-Activity Waste Facility receives

Why it matters

The 586-square-mile Hanford Site is located in south-central Washington along the Columbia River. Hanford's mission included defense-related nuclear research, development, and weapons production activities from 1943 to 1987. During that time, Hanford operated a plutonium complex with nine nuclear reactors and processing facilities.

Hanford, 177 underground storage tanks hold million gallons of dangerous waste. Some tanks have leaked, contributing to more than 70 million gallons of contaminated groundwater currently under the ground. This tainted groundwater threatens the Columbia River, the life that depends on it.



Hanford Education & Outreach Network

Contact us anytime with questions or comments:

- Hanford@ecy.wa.gov
- 800-321-2008

facebook.com/HanfordEducation

...notional facility that can treat this waste for the...
s. Ensuring this is one of Washington State's...
ties at Hanford.

“The **Hanford Reach National Monument** is a unique and biologically diverse landscape, encompassing an array of scientific and historic objects. This magnificent area contains an irreplaceable natural and historic legacy, preserved by unusual circumstances.”

Presidential proclamation (Clinton)



“Hanford – Most Contaminated Nuclear Site in U.S.”



Challenge: Declining Level of Interest



Sandpoint, ID – 1985

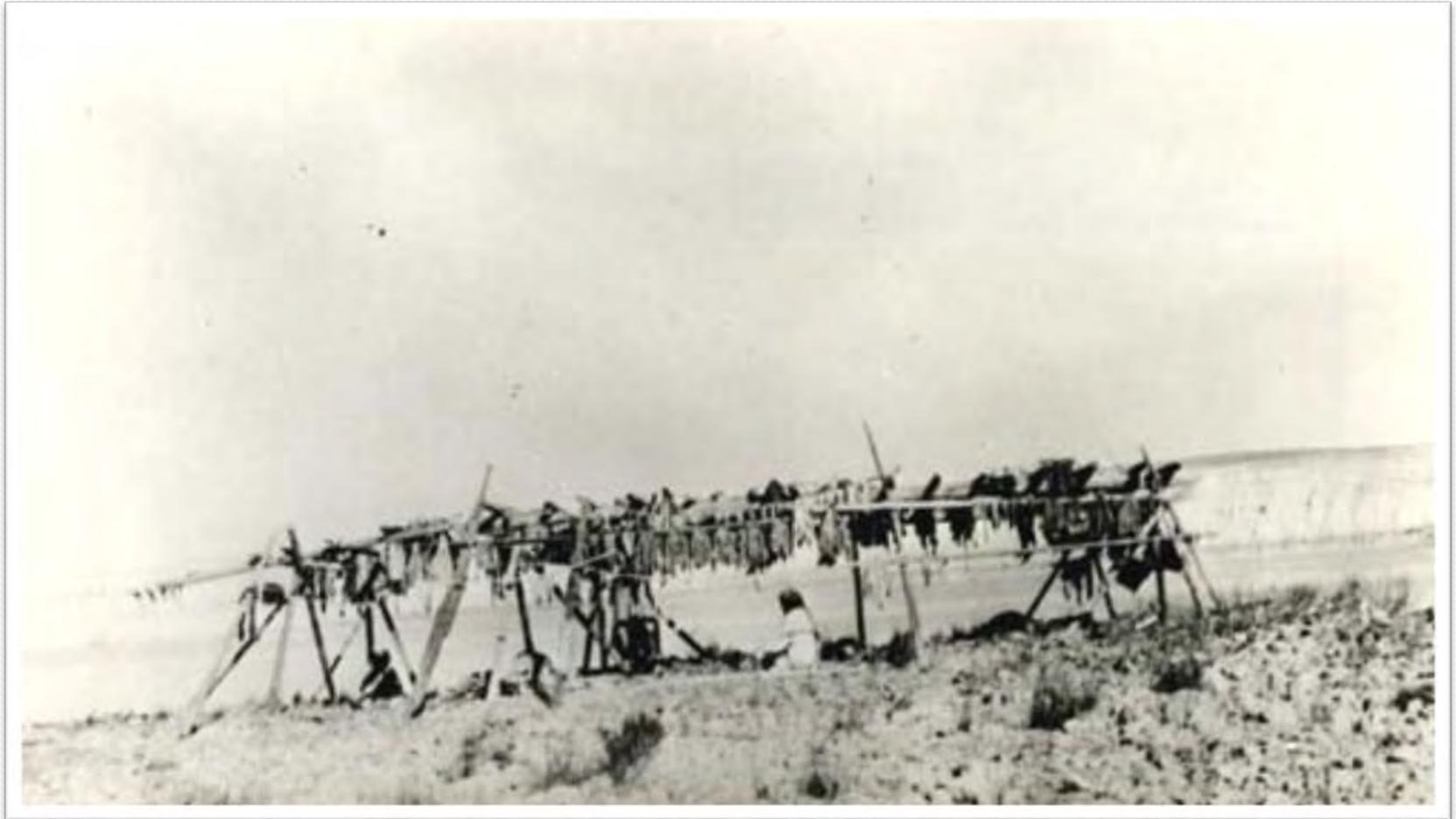


Hood River public meeting – 2012

History - Wanapum Village



Wanapum Fish Drying Rack



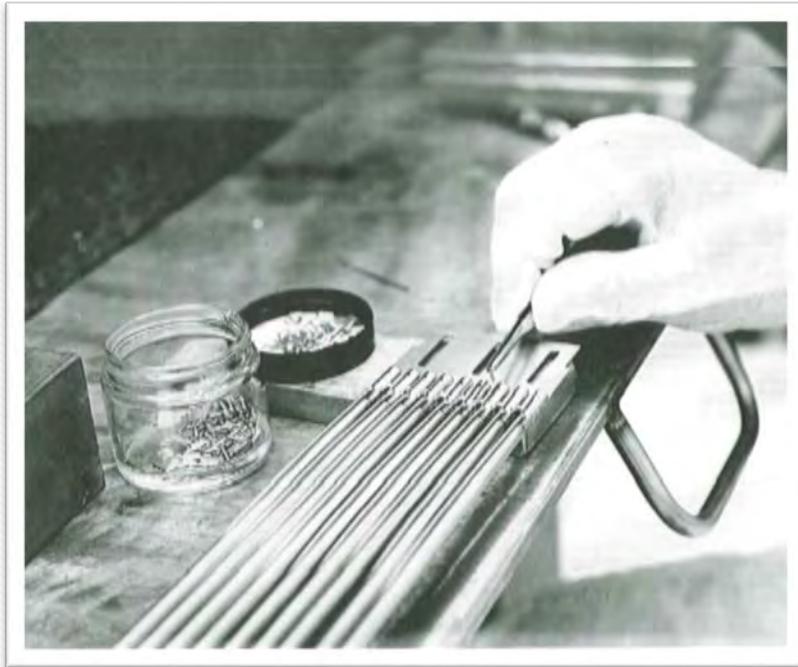
Photographs courtesy Wanapum Band

Hanford Construction Camp

50,000 workers came to build Hanford. It was the 3rd largest city in Washington State!



300 Area Fuel Fabrication



324 Building



Historical view into B cell
through oil-filled window



100-D Reactor Area Construction - 1944

Each reactor area featured massive water treatment facilities and a powerhouse that dwarfed the reactor building itself.

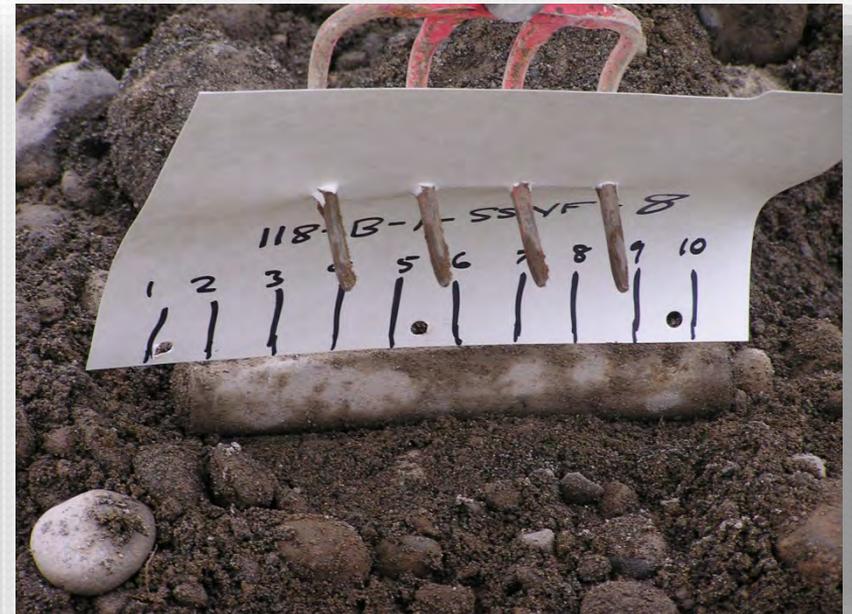


Solid Waste Disposal

50 Columbia Shoreline Landfills



Mercury Tubes – 1000 pounds found at
100-B/C Area



Lost pieces of spent nuclear
fuel - scale on long handle

Holding Ponds for Thermal Load, Short-Lived Radioactivity



B Reactor – 1940s



100-B/C Area Holding Ponds

D Island Pipelines - 1951



The massive amounts of cooling water created situations unimaginable today: 10-foot diameter pipelines came loose from their moorings and whipped around like an uncontrolled garden hose. The Columbia River boiled where the cooling water hit the river.

“Short-lived” radioactivity could be measured as far as Willapa Bay



Richland schoolchildren were checked for accumulated radioactivity

1950s Radiation Experiment - Trout



River Impacts – Today



Groundwater will be pumped and treated for many more years to keep contamination out of the Columbia River.

Extensive monitoring confirms protection.



Central Hanford (10 miles from river) Plutonium Extracted from Fuel



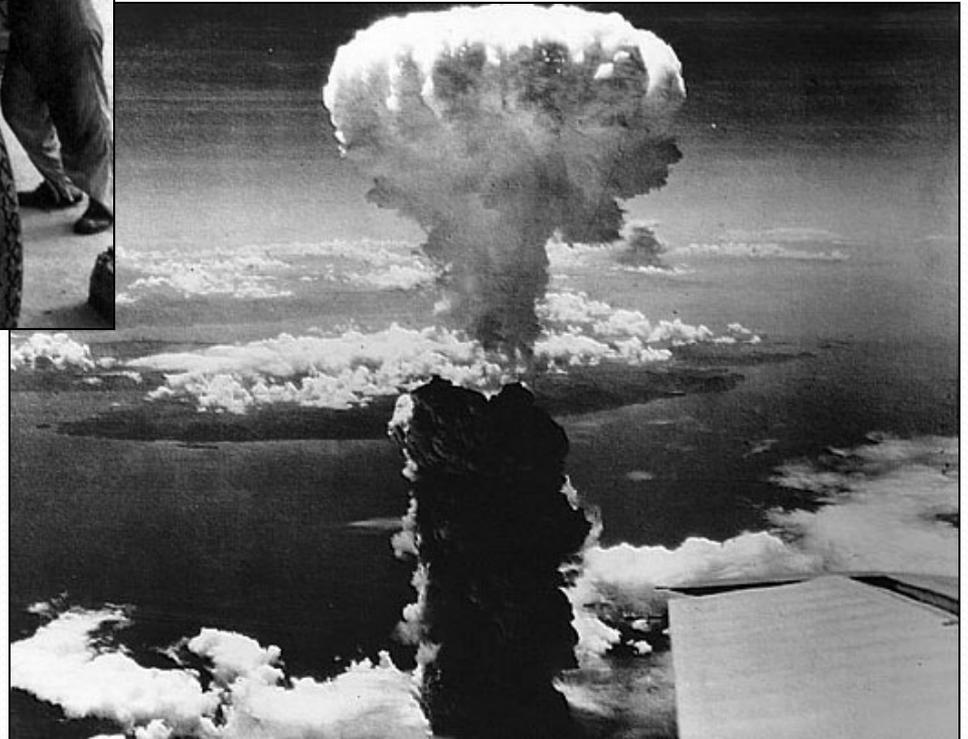
Plutonium Extracted in 6 Massive “Canyon” Buildings





Fat Man Being Loaded on B-29 Bomber

Courtesy of Atomic Archive



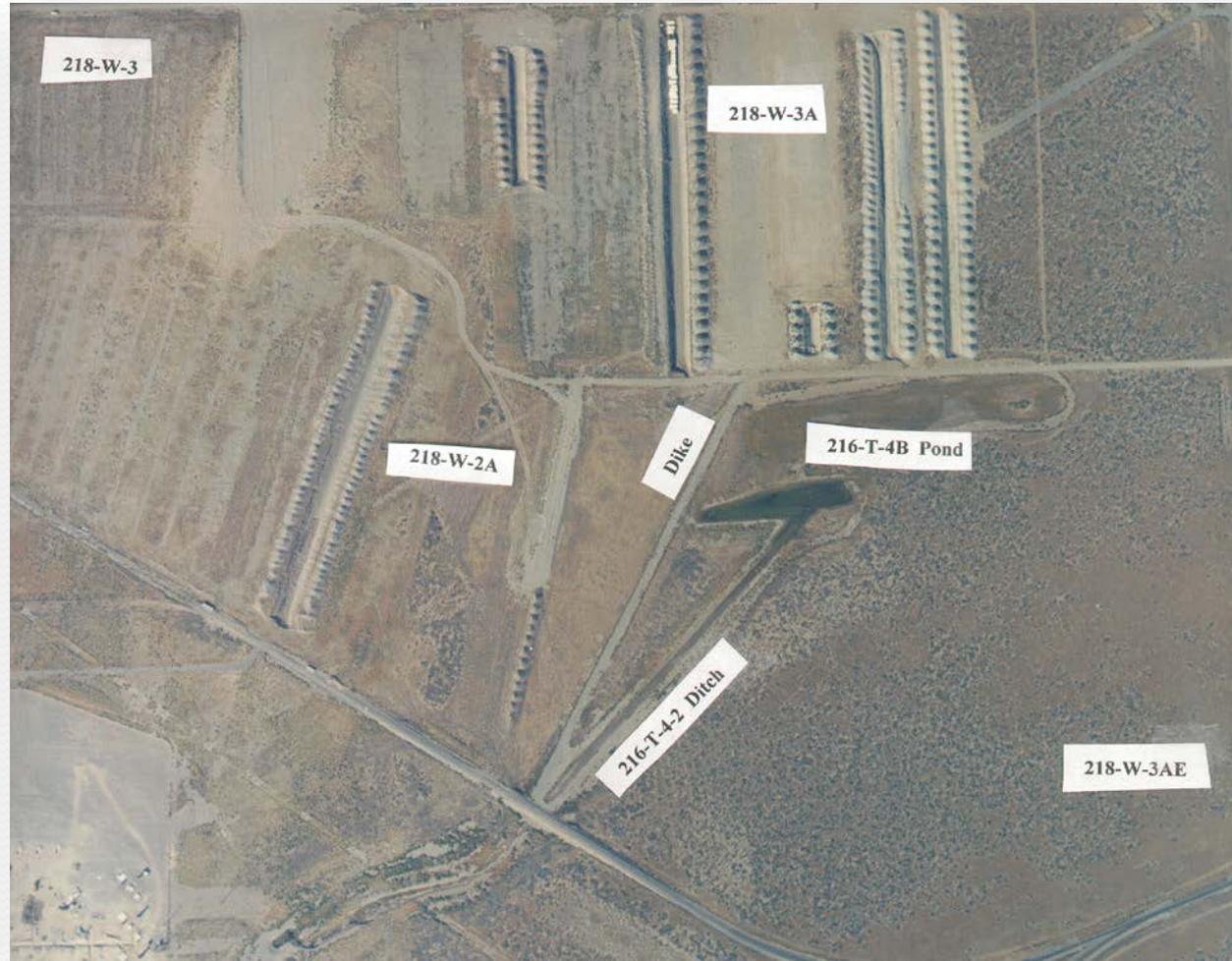
Mushroom Cloud Over Nagasaki, Japan

Courtesy of National Archives

High Radiation Requires Remote Handling



43 Miles of Disposal Trenches



Low-Level Liquid Radioactive Waste Disposed to the Ground



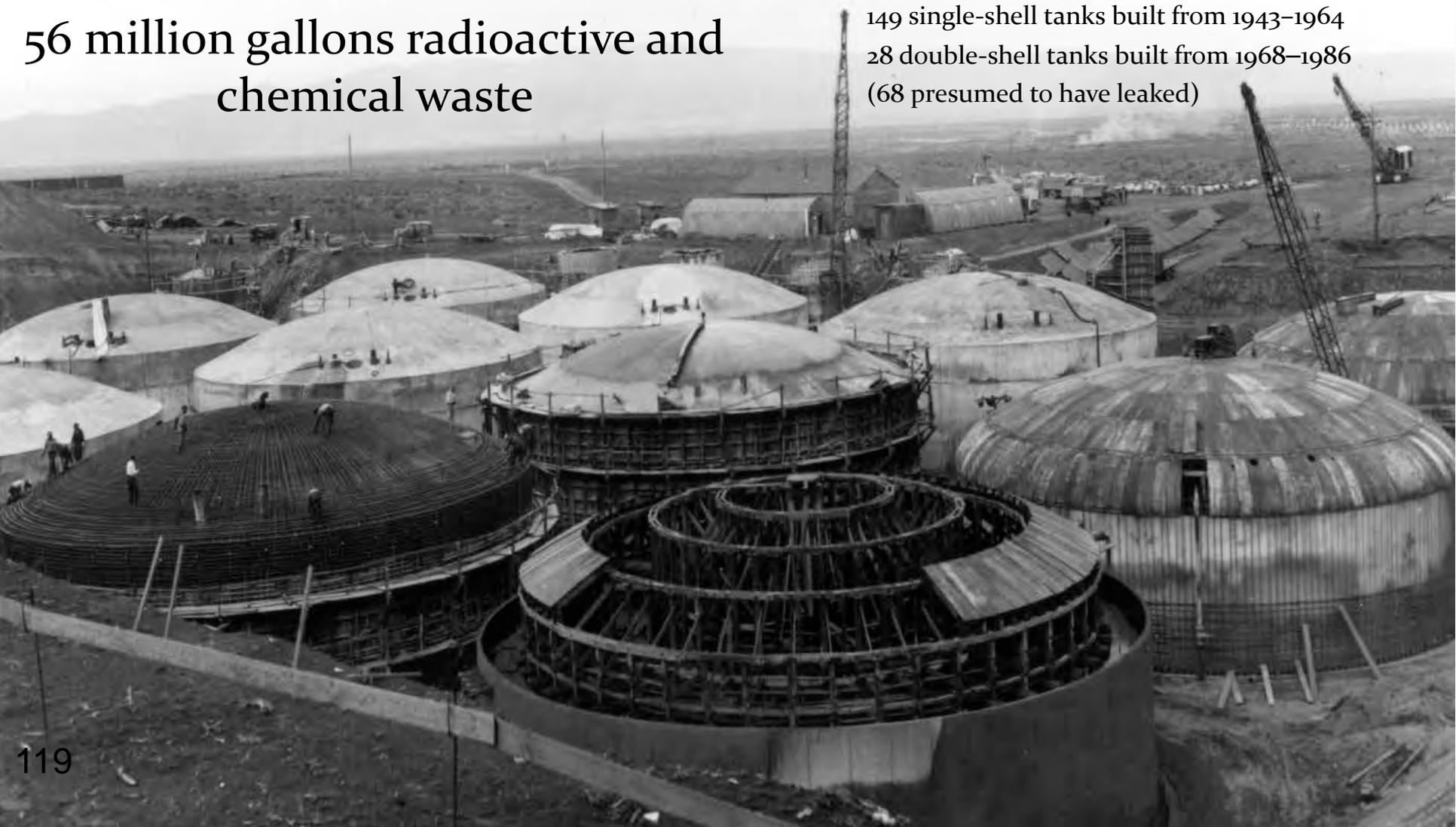
Contaminated Water Will be Pumped and Treated From 1990s to ~2040



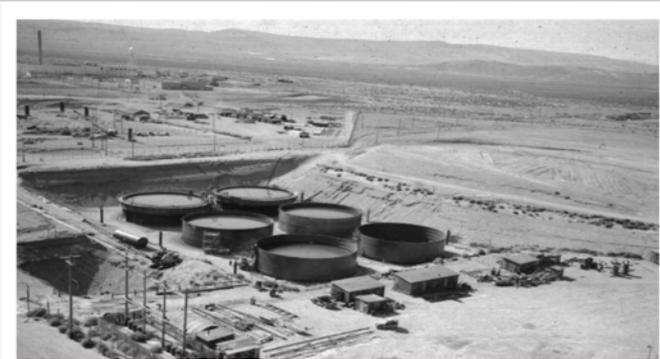
Hanford's Greatest Cleanup Challenge: The Tank Farms

56 million gallons radioactive and
chemical waste

149 single-shell tanks built from 1943–1964
28 double-shell tanks built from 1968–1986
(68 presumed to have leaked)



149 Underground Single-Shell, High-level Radioactive Waste Tanks

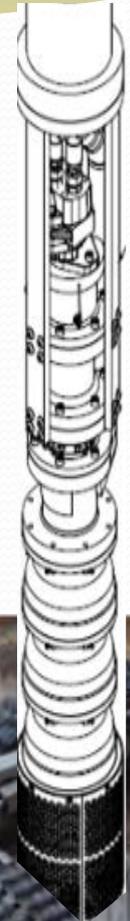


The volume of waste is enough to fill a 2-ounce glass for every man, woman, and child in the U.S. It is equal to 27 seconds of outflow of the Columbia River at its mouth. If piled on a football field, this waste would be 123 feet deep.



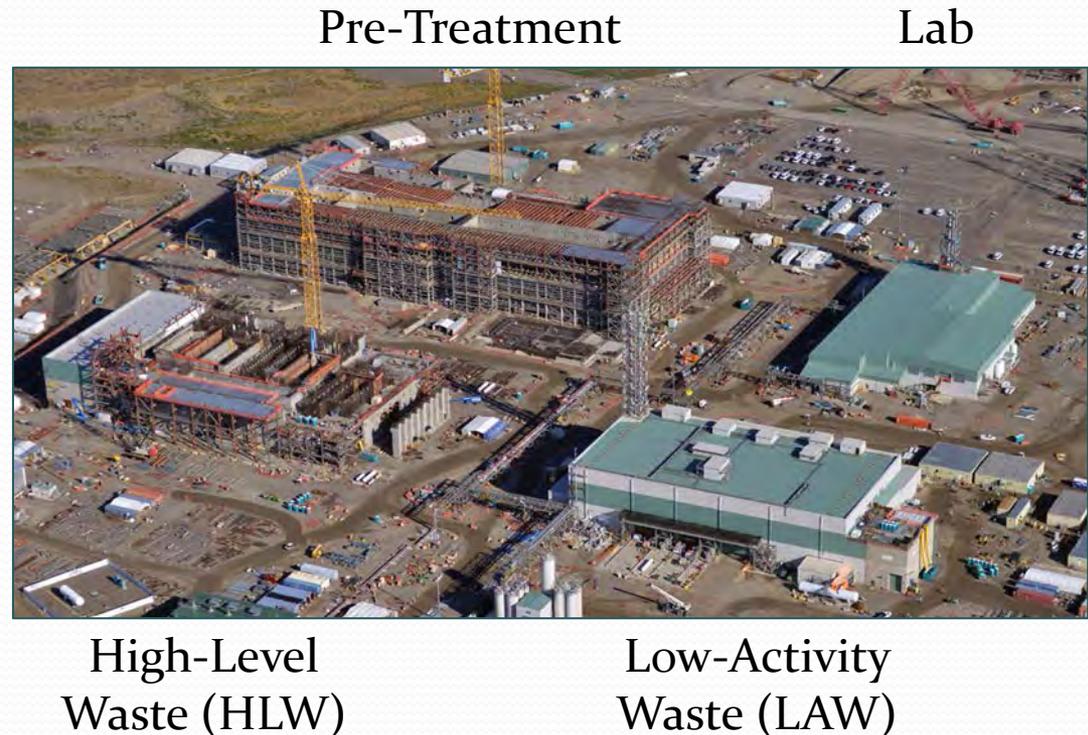
Tank Waste Retrieval Tools

- Variable height pump
- Chemical dissolution
- Modified sluicing
- Mobile arm retrieval system (MARS)
- Fold track



Tank Waste Treatment Plant

- Concrete: 262,000 yards (26,200 trucks)
- Structural Steel: 36,500 tons (equal to *three* Eiffel Towers)
- Piping: 1,017,000 linear feet
- Electrical Cable: 4,762,000 linear feet
- Area: 65 acres
- Capital Cost: \$12+ billion
- Hot Start Goal: 2019



The Waste Treatment Plant in September 2013. Photo courtesy of Bechtel National, Inc.

200 Area Cleanup to Go

- 1,000 waste management units/areas of concern
- 115 cleanup cost, in billion\$
- 65 square miles of groundwater contaminated above drinking water standards.
- 22 radioactive landfills/
43 miles of landfill trench
- 1,000 approximate buildings/facilities
- 177 high-level waste tanks
- 9 plutonium production nuclear reactors
- 5 “canyon” processing buildings



136° PAN 01 AUG 12 |
-6 PSI -82° TILT 22:14



89° PAN 01 OCT 08 |
0 PSI 77° TILT 00:00

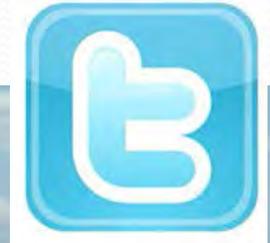
Always Available Online ...

Nuclear Waste website:
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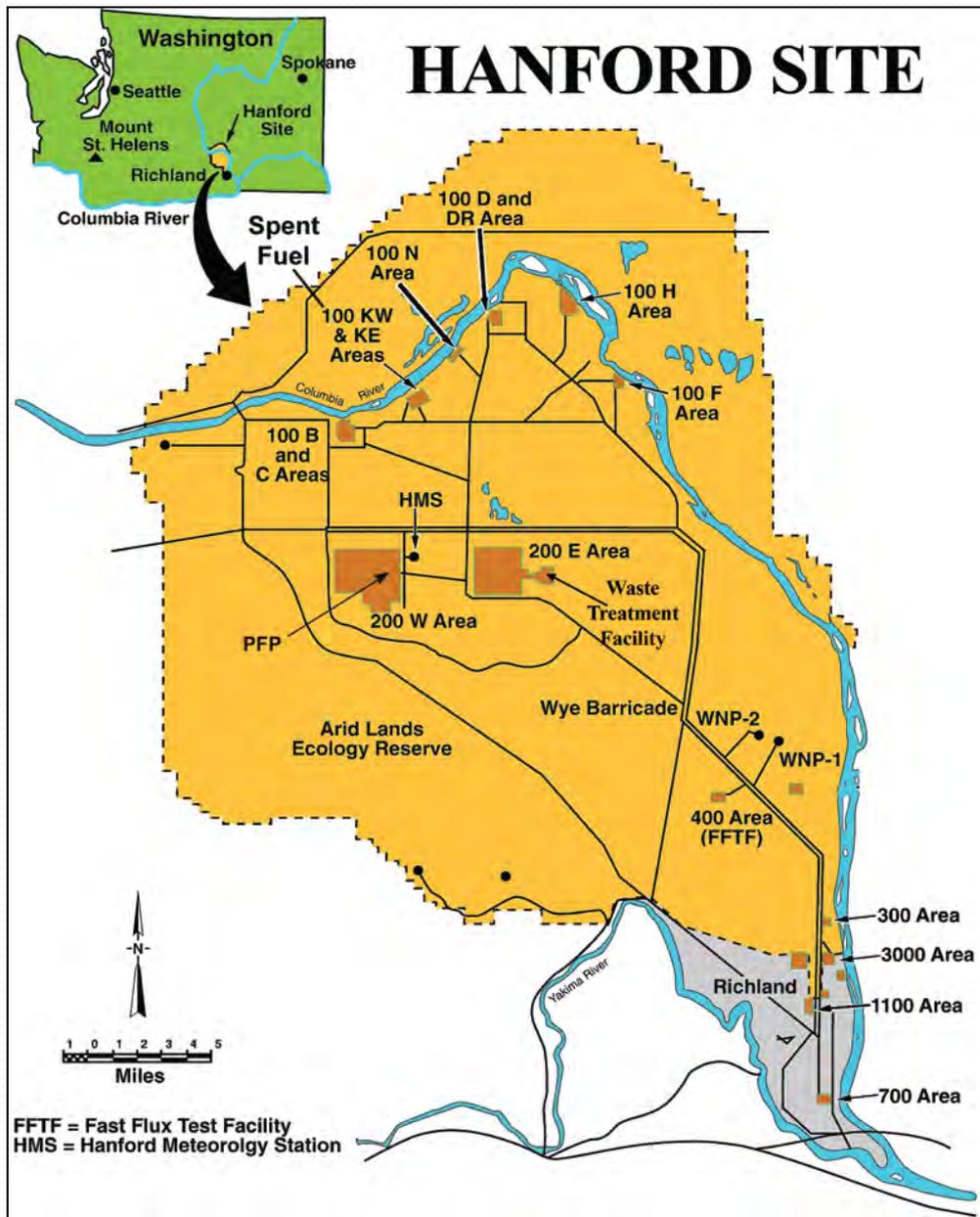
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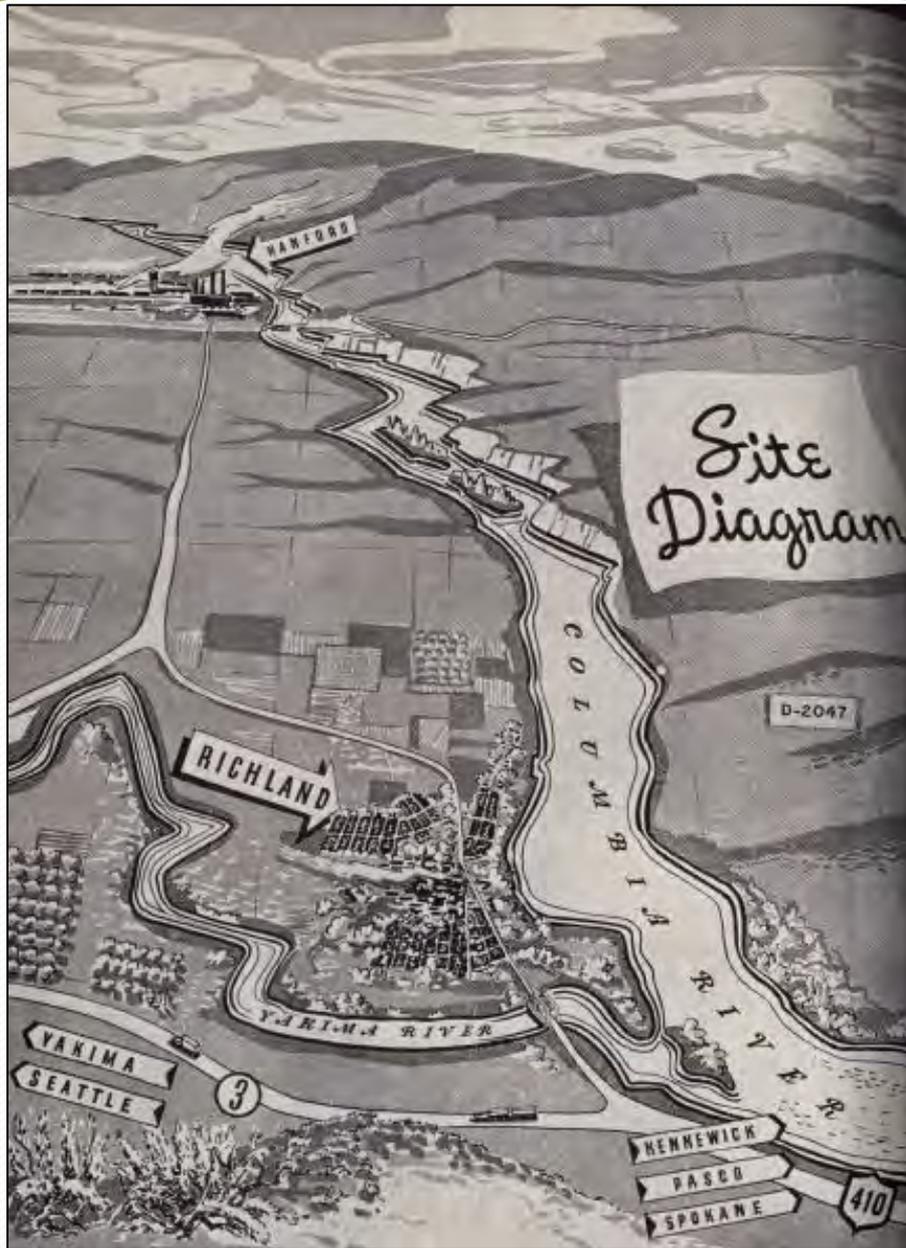
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Hanford Highlights





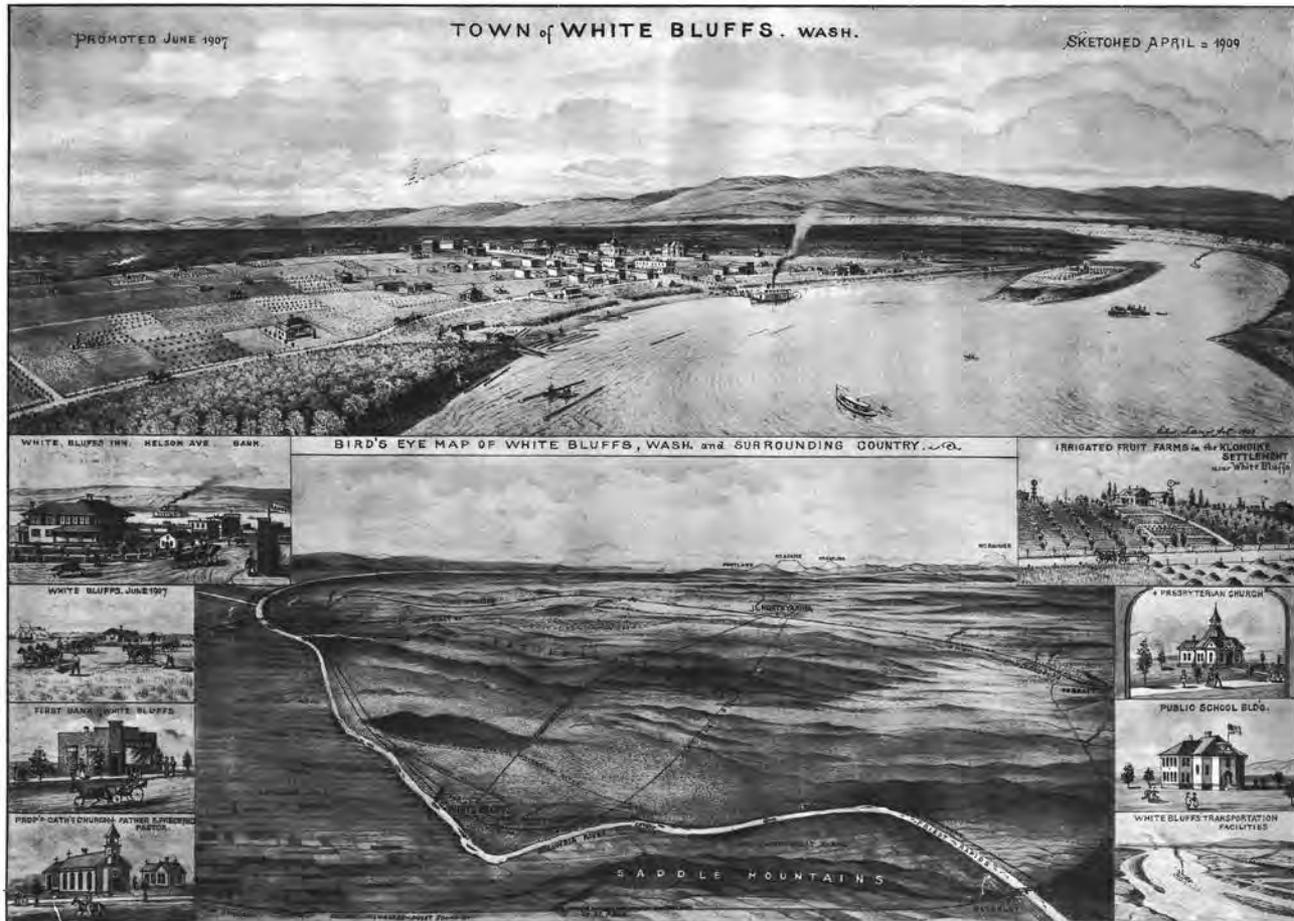
- 586-square-mile site
- 2,400 waste management units/areas of concern
- 72 square miles of groundwater contaminated above drinking water standards
- 177 high-level waste tanks buried underground
- 9 plutonium production nuclear reactors
- 6 “canyon” processing buildings
- 2 sodium-cooled test nuclear reactors
- 72 radioactive landfills
- 43 miles of landfill trenches remaining



Early drawing of the Hanford site and Richland

White Bluffs Promotional Poster, 1909

Courtesy of the Department of Energy



WHITE BLUFFS - ON THE COLUMBIA

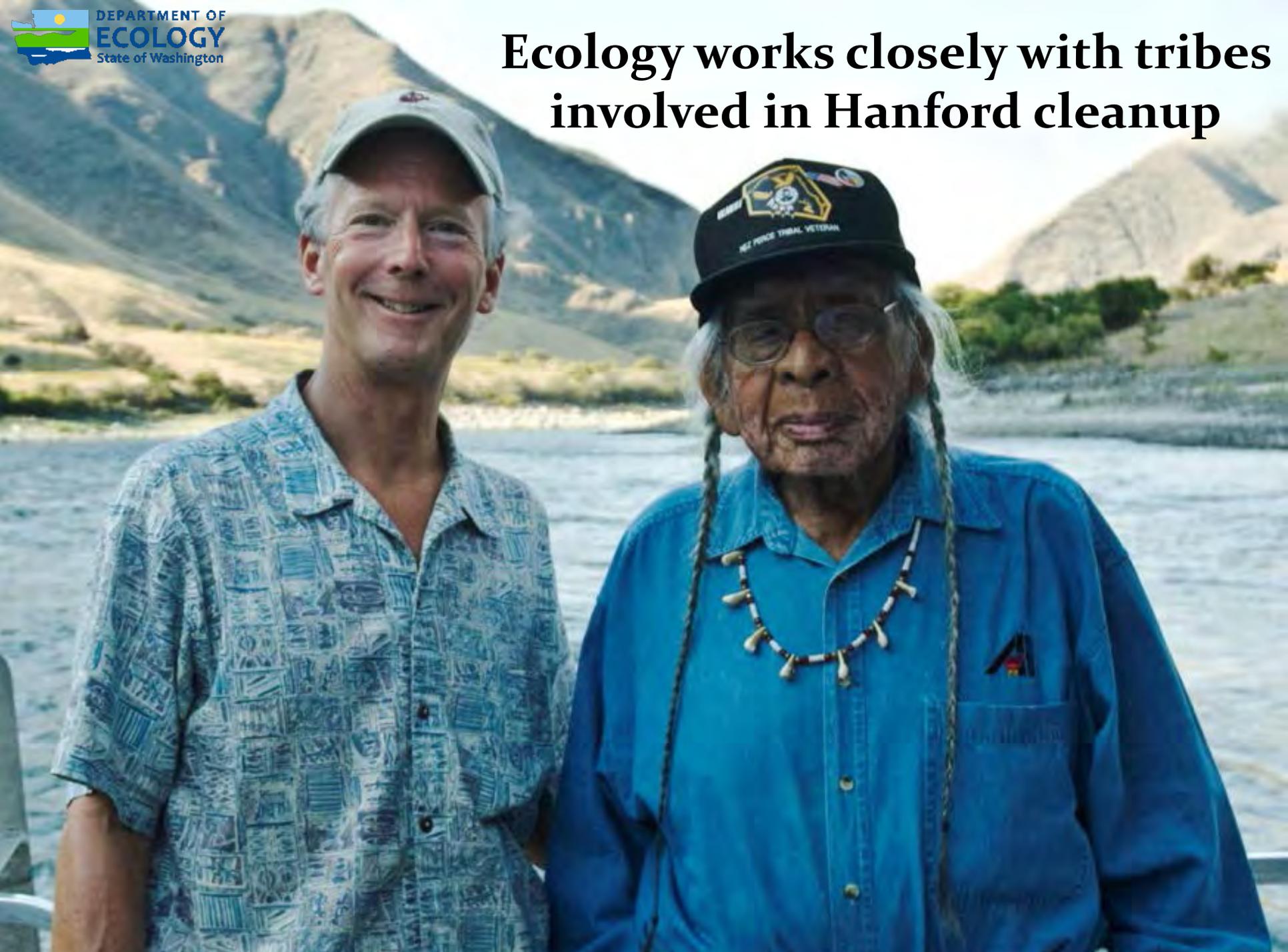
Washington's Record Town. The Greatest Fruit Country on Earth. The Best Climate in the State. The Most Beautiful Scenic

Setting. Great Business and Investment Opportunities.

Wanapum village looking downstream toward Hanford



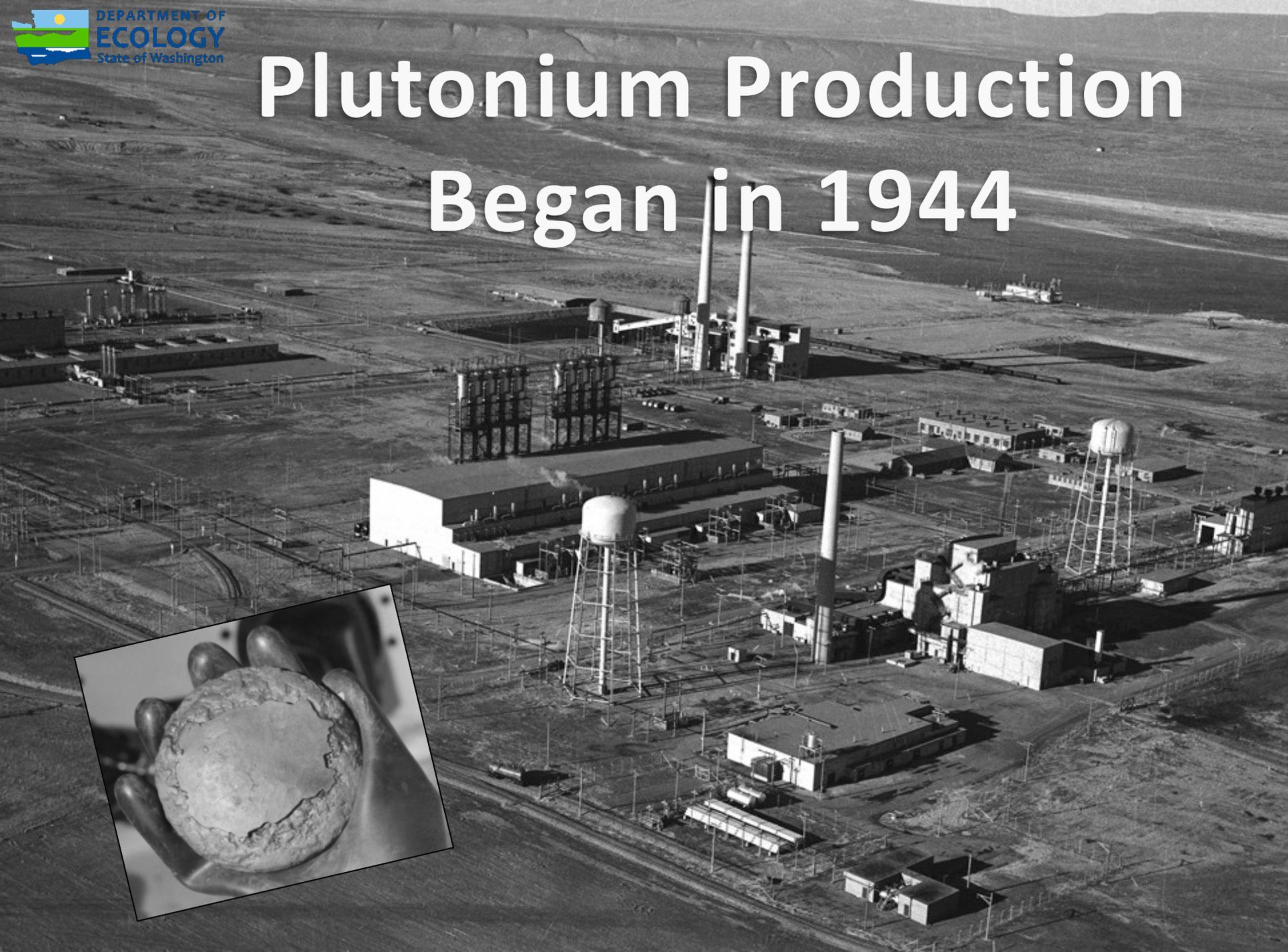
Ecology works closely with tribes involved in Hanford cleanup



Hanford Construction Camp (circa mid-1940s)



Plutonium Production Began in 1944

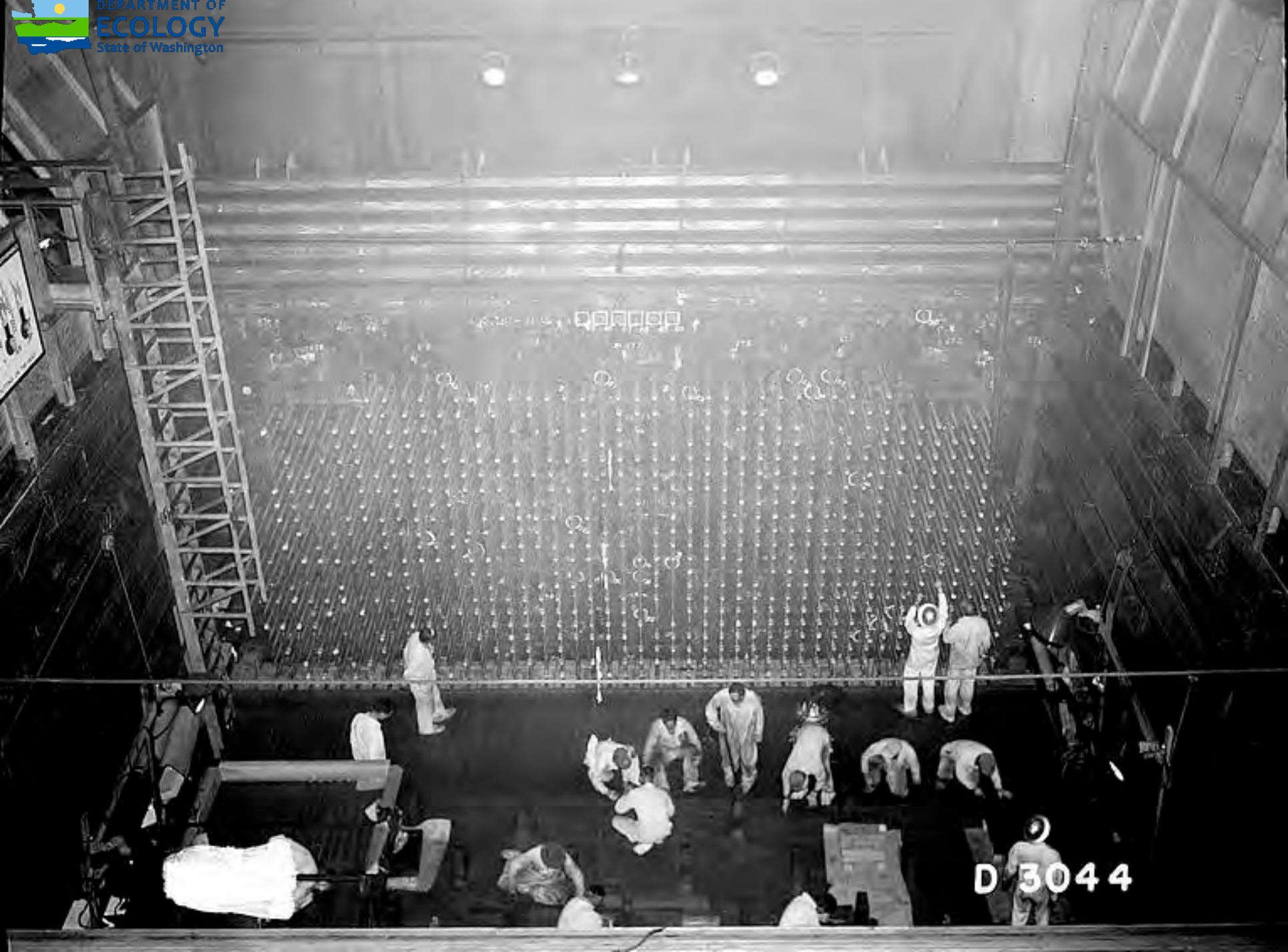






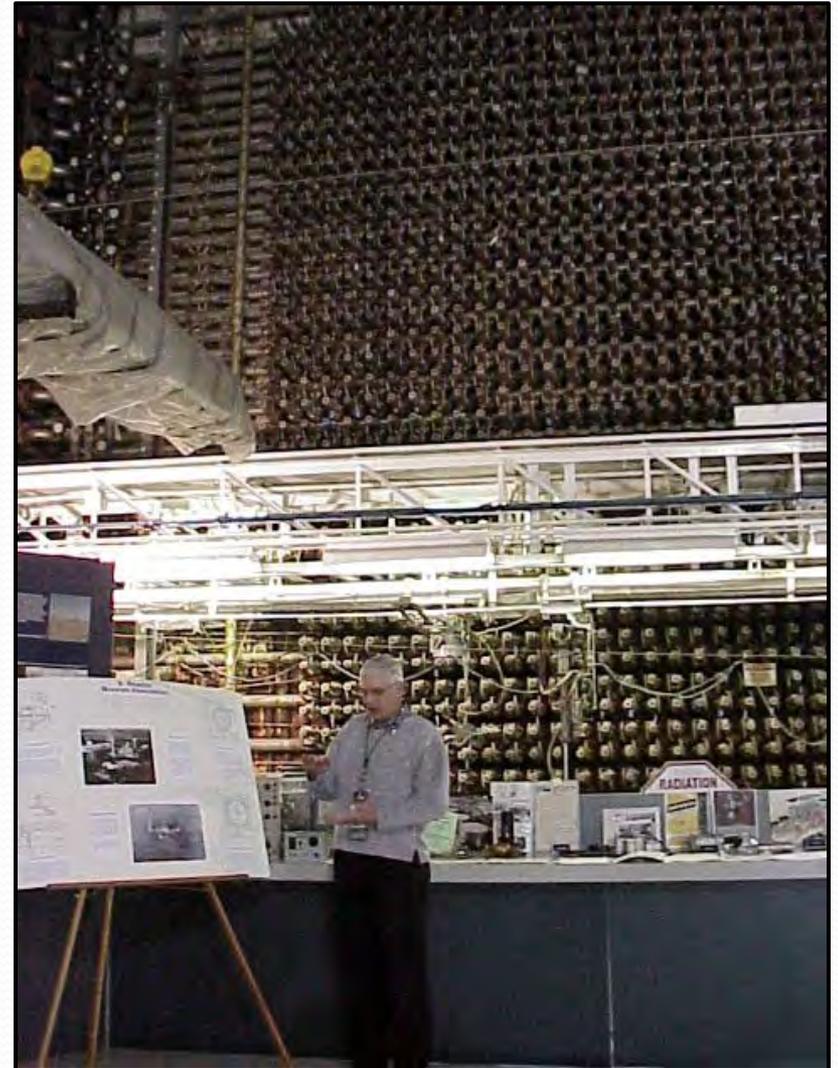
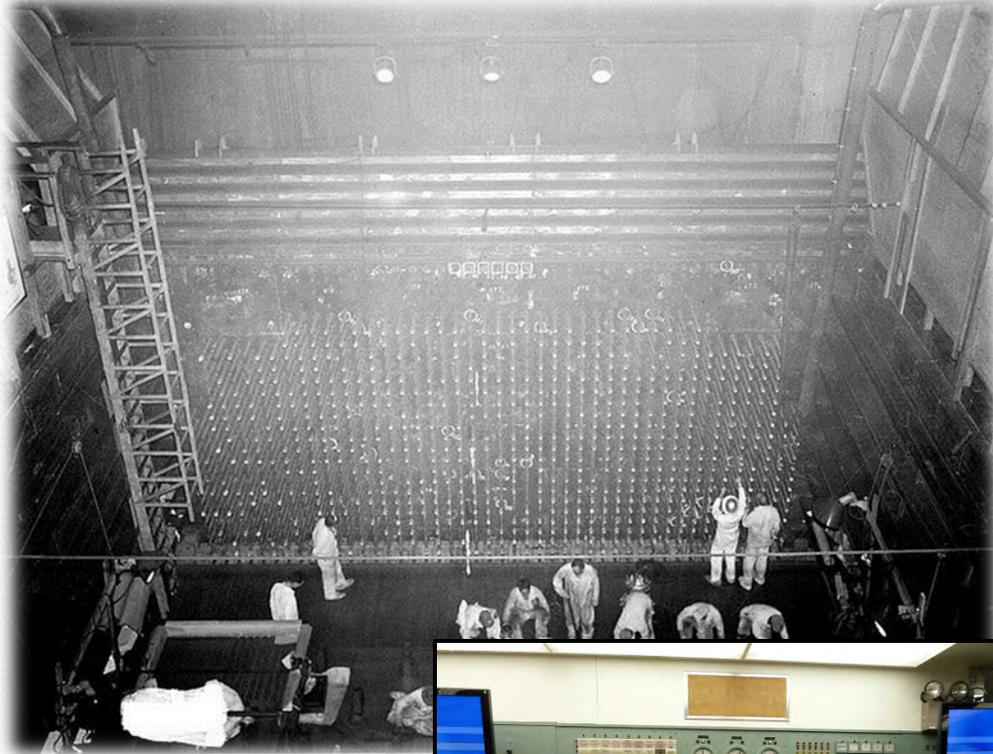
Hanford's Iconic B Reactor





D 3044

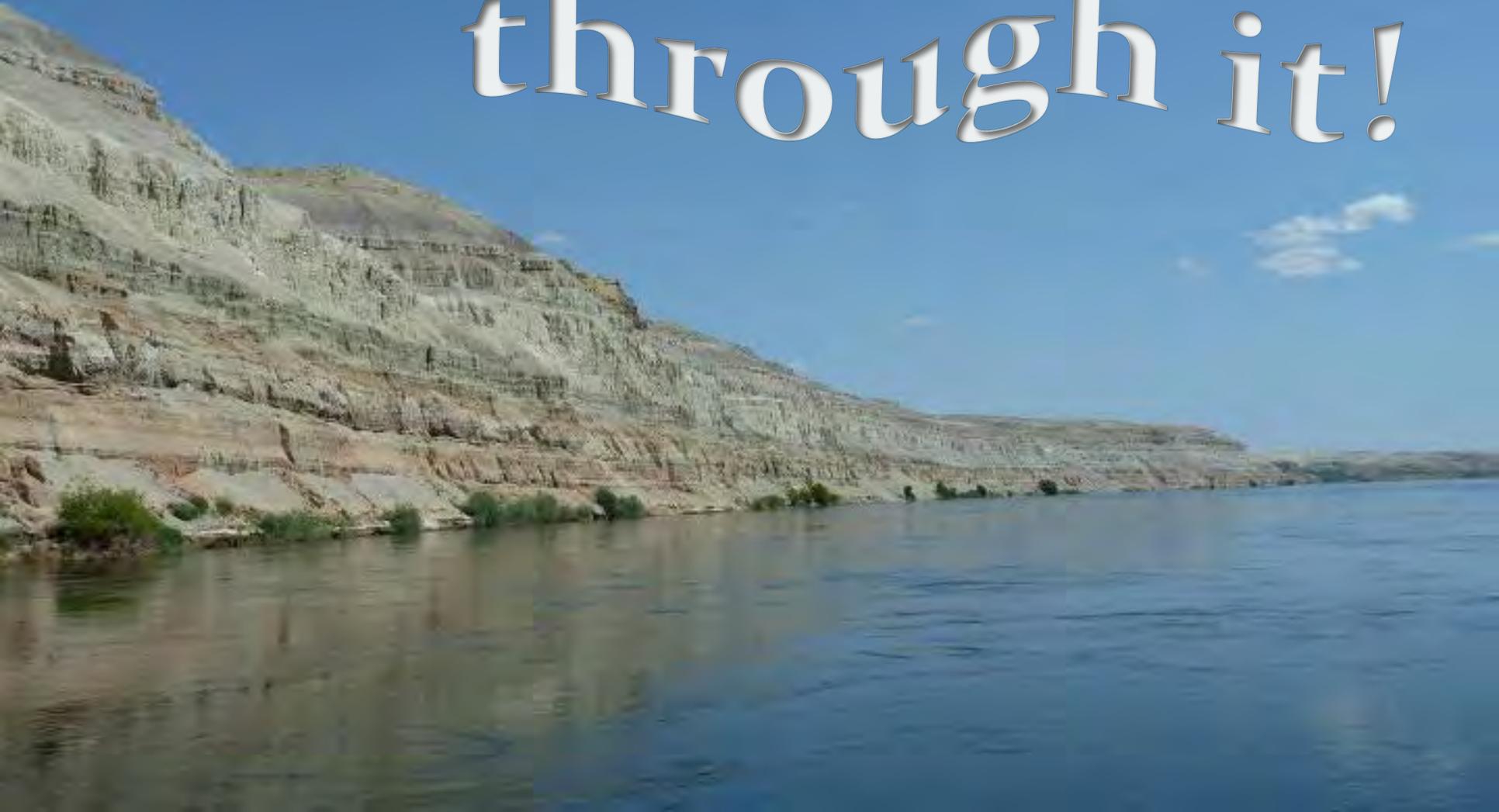
B Reactor then & now



Why Hanford Cleanup Matters



A river runs
through it!







The threat to the river is certainly not exclusively from Hanford. Industrial chemicals, agricultural pesticides, and other contaminants pose both a short- and long-term danger to the beautiful Columbia River.





Wildlife Abounds at Hanford



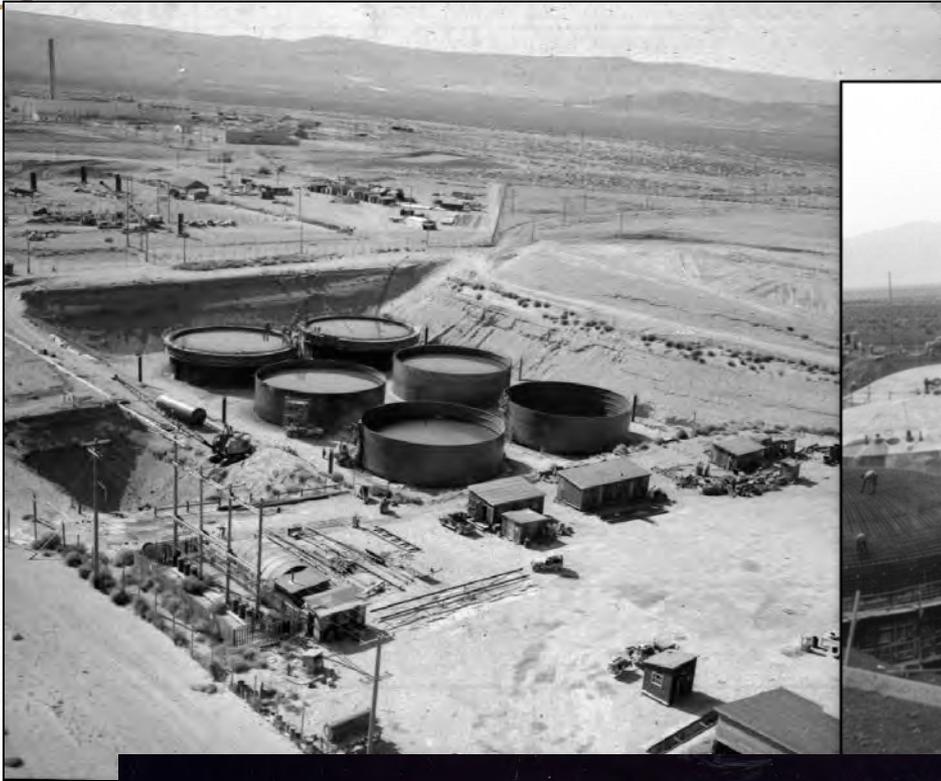
Disposal Practices Like This are No Longer Happening!



**Much Cleanup
Progress Has
Been Made in The
Past 25 Years!**









The Waste Treatment Plant is the
cornerstone of Hanford cleanup.



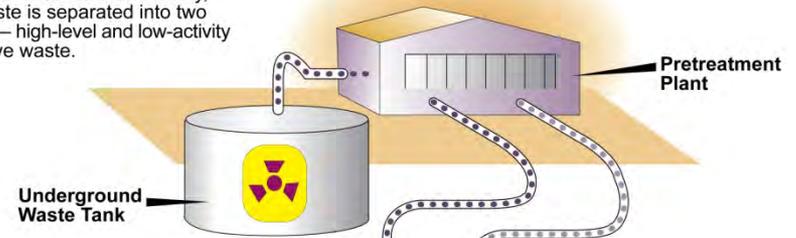
Turning Hanford's Tank Waste to Glass



Vitrification Process

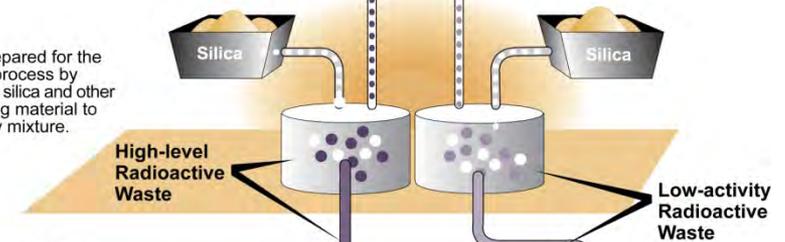
1

At the WTP Pretreatment Facility, liquid waste is separated into two streams — high-level and low-activity radioactive waste.



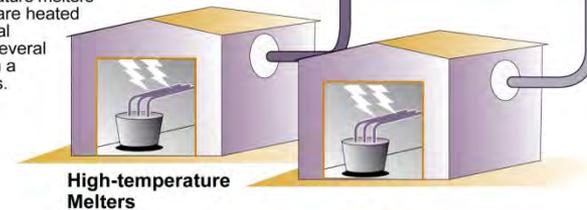
2

Waste is prepared for the vitrification process by mixing it with silica and other glass-forming material to form a slurry mixture.



3

The mixtures are fed into high-temperature melters where they are heated with electrical current for several days to form a molten glass.



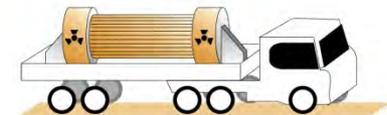
4

The molten material is then poured into large stainless steel containers or canisters and returned to a solid state by cooling for several days.



5

The containers and canisters are sealed and decontaminated.



6

The low-activity radioactive waste containers are stored in a lined trench on site. The high-level radioactive waste canisters are stored until shipped to a federal facility for permanent disposal.

Want to Know More About Hanford?

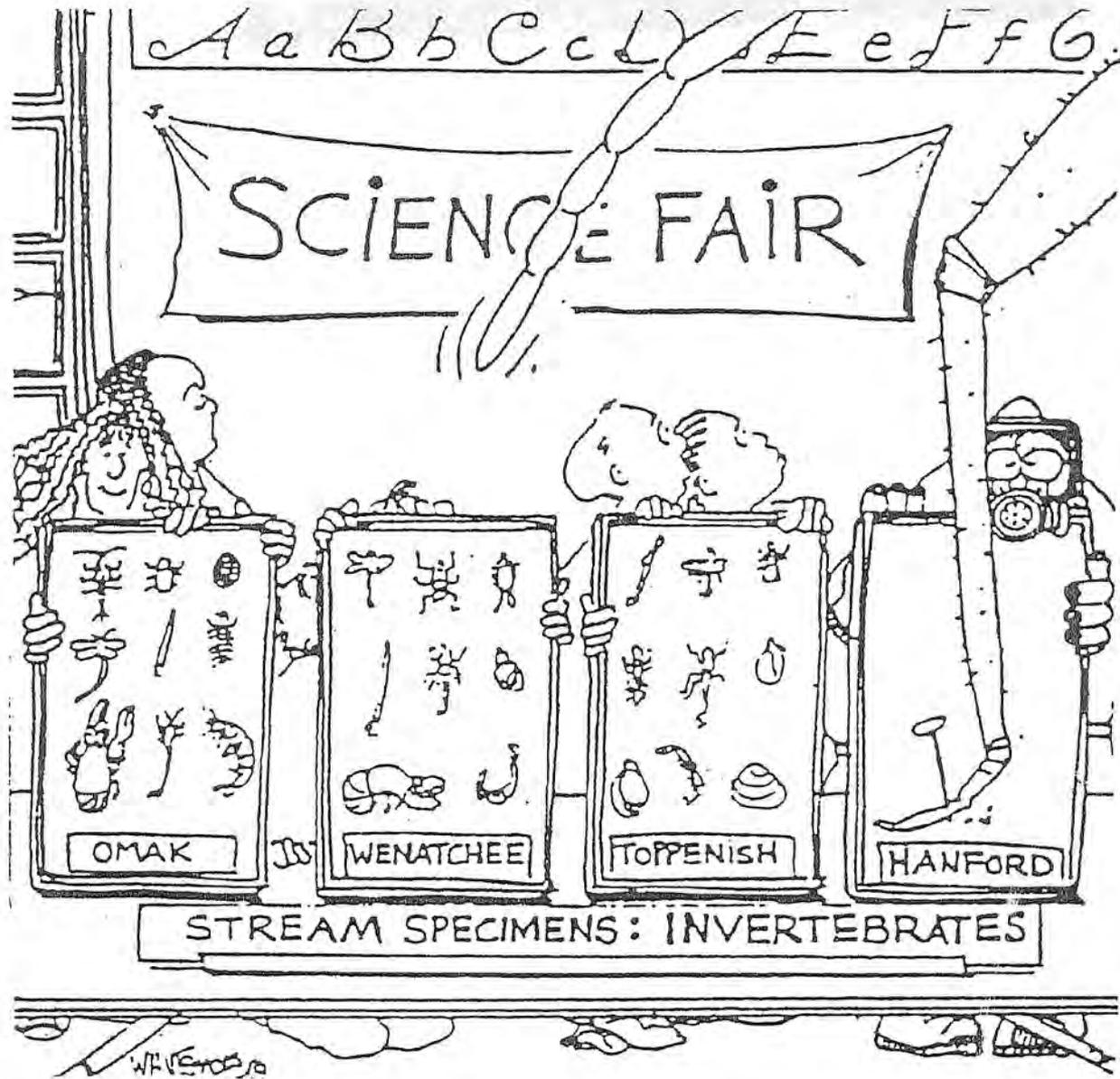


Get informed!
Stay informed!
Inform others!

- www.ecy.wa.gov/programs/nwp
- Hanford.gov

Ecology staff is available to speak to your classroom or group!





How some people think of Hanford...

Secret Cities...

The Hanford Site was one of three locations involved in the top-secret Manhattan Project. Can you name the other 2?

Answer: Oak Ridge, TN and Los Alamos, NM



Tri-Cities Population

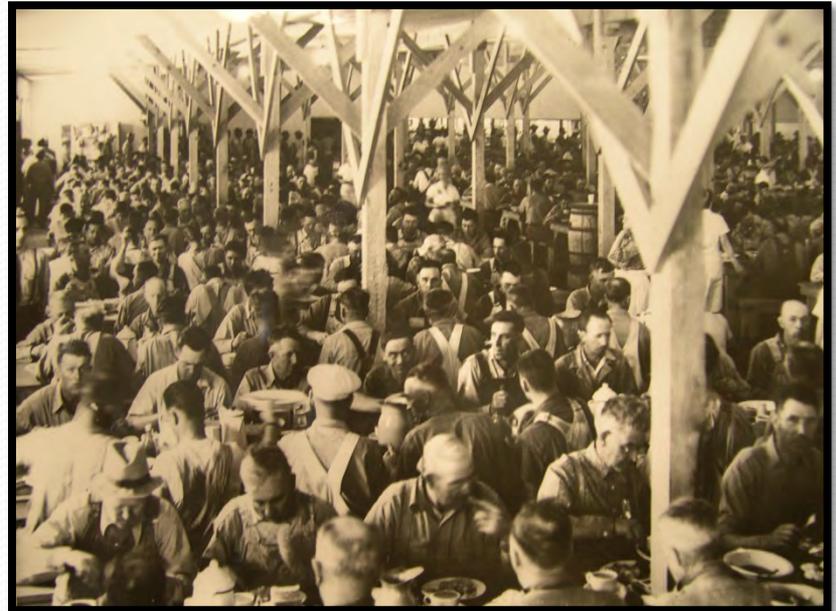
	1940	1950	2010
Richland	247	21,809	48,058
Kennewick	1918	10,100	73,917
Pasco	3913	10,200	59,781
Hanford	436		

Thirsty?

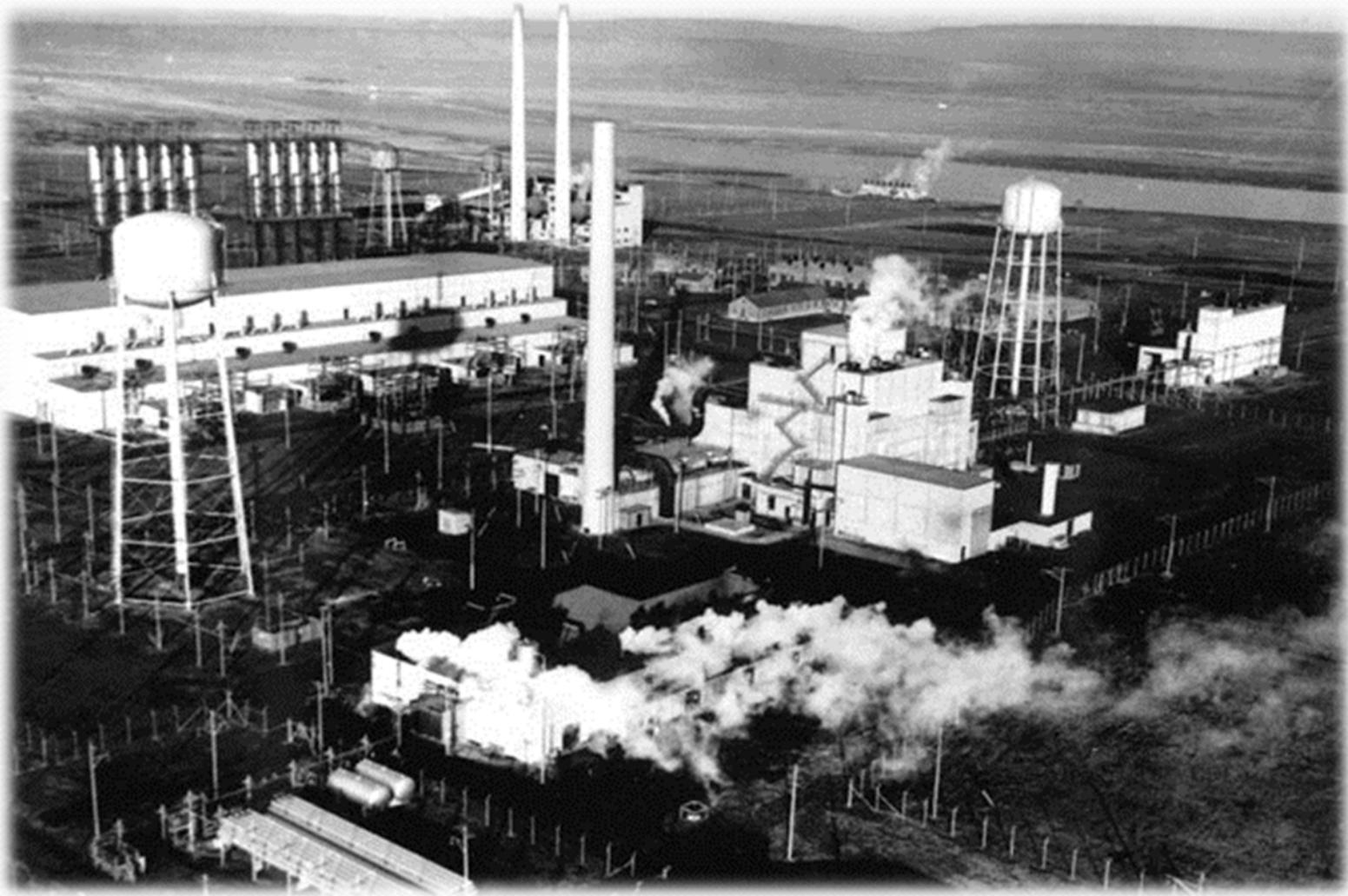
Get your coffee this morning?

Hanford workers sure did during construction in the mid-1940s. How much coffee was consumed each day?

Answer: Hanford's 8 mess halls made 1,000 pounds of coffee a day. That equals about 344,000 cups. Enough to keep 50,000 workers wide awake.



Production: 1945-1988



Plutonium from Hanford was in the First Test of an Atomic Bomb

When?

Where?



July 15, 1945 in White Sands
Missile Range, NM

Code name: Trinity

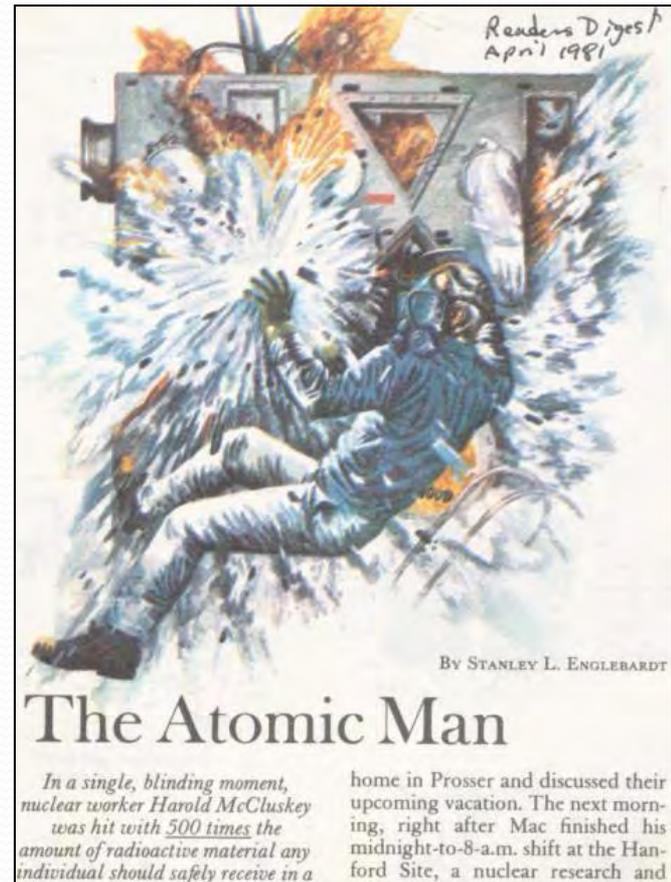
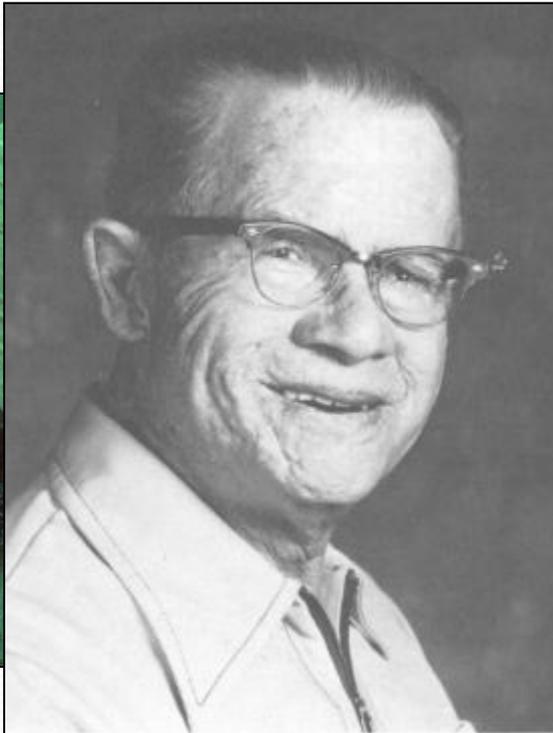
How Much Plutonium did Hanford Make?

More than 67,000
kilograms!
(147,709 pounds)



Who was the Atomic Man?

Harold McCluskey 1912 - 1987



Cleanup Challenges

~65 square miles of
contaminated groundwater

~43 linear miles of unlined
solid waste landfills

2,400 waste
management
units/areas of
concern



56 million
gallons of waste
in 177
underground
tanks



Contaminated soil and
buildings



Cleanup Accomplishments

- Stopped liquid discharges to soil
- 15 million tons of contaminated soil removed from river shoreline
- 20 years groundwater pumped, treated to protect Columbia River
- 6 of 9 reactors cocooned; 1 preserved as national landmark
- Most pumpable liquids removed from 149 single-shell tanks
- Records, soil & water sampling have better defined the problems we face – we have a plan!



Want to Know More About Hanford?

Get informed!
Stay informed!
Inform others!



- www.ecy.wa.gov/programs/nwp
- www.Hanford.gov
- Hanford stakeholder groups



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