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2022-09-25 the nevada national security site pt 4

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And now, the conclusion.

Lunch at the Nevada National Security Site is a strange experience of its own. Our coach dropped us off at the Bistro, a second, smaller cafeteria located further into the site and thus more conveniently to many of the workers in the field. The chef of this small operation, who was equipped with quite a bit of personality, made an admirable effort to keep up with the rush of tour guests but we still had to wait for some time. This allowed the opportunity to take in the posters, one of which advised that cash would soon no longer be accepted... starting 2018. There was plentiful evidence that the workplace posters of the NNSS enjoy far longer lives than anyone anticipated.

Our guide took us to eat in a nearby conference room. One long wall of the room was covered in butcher paper and delineated into sections, with printed pages (apparently work orders) pinned up in the various columns. Kanban, originally a method of scheduling manufacturing operations, has found wide adoption in federal contracting. Whether this is attributable to its efficacy or to the needs of the defense industrys large contingent of Agile consultants is unclear.

After lunch, we re-boarded our coach to head back out into the range. Along the way, our guide pointed out the yard where drilling equipment was stored, ready to be put back to use if the order ever came. There was a reprisal here of an interesting point our guide had mentioned previously: in his opinion, at least, the methods used to drill the large, straight boreholes used for the tests had been largely lost to history.

This is something of a recurring theme with nuclear weapons, and one of the more troubling challenges to stockpile stewardship. Some readers may be familiar with the widely reported case of FOGBANK. FOGBANK is a classified material used for a classified (although disclosed by a previous Undersecretary of Energy) purpose in several nuclear weapons. Originally manufactured in the 70s and 80s, FOGBANK had become more of a secret than ever intended by the time a need arose to produce more, in the 00s. Little documentation had been kept on the manufacturing process, the facility had been decommissioned, and few people involved in the 70s were still around. It took nearly a decade and over $100 million to reverse-engineer the process that the same organization had run successfully less than 50 years before.

The deeper context of FOGBANK provides a good example of the challenges of stockpile stewardship. FOGBANK is a component of the W76 nuclear warhead, in use to this day on

the Trident II submarine-launched ballistic missile (SLBM). The W76 was designed at Los Alamos and manufactured across various facilities from 78 to 87. The W76 was originally designed, though, for the Trident I, and the Trident II was to carry its successor, the W88.

Because of the abrupt shutdown of the Rocky Flats Plant near Denver, where plutonium pits were manufactured, the W88 project was effectively canceled very early in its production run. The rapid and unexpected shutdown of Rocky Flats has had a pervasive impact on the modern state of the stockpile, as it was one of the most sophisticated facilities for manufacturing with special nuclear material and had been the planned site of several different major manufacturing runs. This, of course, raises the question of why exactly Rocky Flats abruptly closed its doors in the early 90s. The answer is one of the foremost embarrassments of the weapons program, and a story that (almost certainly intentionally) is not widely known.

To make a long story short (the Rocky Flats saga could easily make up multiple posts on its own), Rocky Flats was plagued throughout the 80s by extensive complaints and demonstrations related to the plants environmental impact and alleged releases of contamination. These might have been dismissed as typical objections to a weapons facility near a major city and Denver in particular. Certainly most other similar facilities had also been the site of such demonstrations. Something was different at Rocky Flats, though, and the root of that difference was the 1980 passage of CERCLA, the Comprehensive Environmental Response, Compensation, and Liability Act.

Some readers may know that besides Cold War history, the history of CERCLA and broader efforts to address environmental contamination is one of my key interests. CERCLA is a landmark piece of legislation, spurred by incidents like the Valley of the Drums (a massive, unmanaged open chemical dump in Kentucky) and broadly increasing public concern about environmental contamination. CERCLA is expansive, but is best known for creating the National Priorities List or NPL, more often referred to as the Superfund program. More generally, CERCLA established in federal law an important basic principle: that organizations which cause environmental contamination are liable to remediate it, and that the federal government is empowered to force them to do so.

And so, unlike the nuclear protests on environmental grounds of the 60s and 70s, the issue of Rocky Flats became a series of complaints to federal regulators. Contrary to the insistence of the Department of Energy and Rocky Flats operating contractor Rockwell, regulators found these complaints quite credible.

On June 6, 1989, the FBI arranged a meeting at Rocky Flats to discuss a threat of terrorism against the plant. The threat wasnt real, or at least it wasnt a threat of terrorism. It was a search warrant. Following this unprecedented raid on a nuclear weapons facility by federal law enforcement, a long and fraught series of proceedings lead to criminal and civil fines against Rockwell and drafted indictments against both Rockwell and Department of Energy officials. A grand jury alleged pervasive, systematic practices of violating the plants EPA and state environmental permits and then covering it up. Although Rockwell did pay the largest fine ever at the time for environmental contamination, the criminal proceedings were ultimately dropped as a result of a settlement agreement. This settlement agreement remains controversial to this day, with many alleging that the Department of Energys cover-up effort extended into the Department of Justice, which agreed to quietly resolve the scandal and seal the court proceedings. Although substantial documents including the Grand Jurys report were leaked to *Westword* (one of my favorite papers), large portions of the Rocky Flats scandal remain sealed to this day.

As a result of the Rocky Flats raid, the DoE replaced Rockwell with EG&G and launched a massive environmental remediation program at the site. Despite DoEs defensive reaction to the federal (and later congressional) investigation, the environmental problems at Rocky Flats were at the time already known to be incredibly, almost intractably, severe. The writing was on the wall for Rocky Flats, and in 92 the W88 program was canceled and shutdown of the Rocky Flats plant began. Both cleanup efforts and lawsuits continue today, but most of the Rocky Flats site is now Rocky Flats National Wildlife Refuge. Most of the cleanup is completed, although often under modified, more relaxed requirements under the agreement that the site will remain under federal management and limited use.

With the W88 canceled just about as soon as production began, *something* needed to be placed on top of the Trident II, and that was the already thirty- year-old W76. No serious efforts were made to replace the W76 after the embarrassing failure of the W88 program, and so in 2000 a Lifetime Extension Program was initiated to refurbish the aging W76s. This program was delayed for years by the inability to reproduce FOGBANK. The program eventually designed the W76 Mod 1, essentially a minor revision of the design, and original W76s were modified to the Mod 1 design. Starting in 2019, some W76 Mod 1s were further converted to a Mod 2 design.

The W76 is now solidly 50 years old, and we are still tinkering with them to both keep them working and modernize them with current fuzing and firing systems. To a very real extent, the nuclear weapons complex created this problem for itself through its long-running lack of concern for environmental stewardship and frequent inability to play well with other federal government priorities. The maintenance and modernization weapons is made slow and expensive by the steady atrophy of expertise and experience in the weapons program, resulting from the boom and bust nature of nuclear weapons where the program tends to alternate between full tilt and near dormancy depending on the political climate.

And throughout all of these problems is the pervasive issue of secrecy. The weapons program is widely accused of actively avoiding oversight. It operates under such secrecy that its difficult to tell where this accusation has merit, although its hard to imagine there are many places where it doesnt have at least some.

This is all a wide tangent from the NNSS, but its the kind of thing you think about as you watch miles of mostly undistinguished desert go by. It was a bit of a drive to our next destination, the Sedan crater.

The Sedan crater is probably one of the best-known artifacts at the NNSS. It is certainly the most visually striking. Sedan is one of several experiments from the short-lived Plowshares program, which aimed to find peaceful civilian uses for nuclear weapons. While many of the more practical-seeming civilian uses of nuclear weapons were evaluated under other programs (e.g. nuclear rocket propulsion), the Plowshares project focused mostly on uses of a civil engineering nature. Major Plowshares efforts included excavation, blasting of mountain passes for road construction, and oil and gas stimulation.

The Sedan crater at the NNSS is the result of an experiment in excavation by nuclear weapons. A nuclear device was buried at a depth that was calculated to produce the largest possible crater, and then detonated. The 104 KT device moved 12 million tons of earth, creating a 320 foot deep crater measuring 1,280 feet from ridge to ridge. These numbers do not quite convey the size of the crater, which rises abruptly from the level desert and feels from the edge like its own small world. A viewpoint has been erected at a low spot in the crater ridge, and so from the platform the ridge

blocks the view out of the crater. The resulting effect is very much like the alien planets of Star Trek, seeming both like a pedestrian bit of California desert and like nothing here on Earth.

By the viewing platform is a metal frame that was once used to winch a wheeled moon buggy down into the bottom of the crater, where workers drilled an exploratory hole to collect soil samples. The bottom of the crater shows a few remains of this drilling operation but mostly old tires, which our guide assumes are the result of occasional bored workers trying to get them to roll the whole way down. Radiation levels at the crater are quite low at this point, although travel to the bottom of the crater is not permitted for safety reasons.

The Plowshares project was not particularly successful or well-received by the public, for all the reasons you would think. The Sedan test did involve the release of an appreciable amount of radioactive contamination, and it would have been unwise to use the site for some time after. Plowshares-like efforts to both excavate and stimulate oil and gas production were more successful in the Soviet Union, but the USSR suffered a correspondingly higher number of serious accidents and some of the resulting contamination still poses a danger today.

As we left the Sedan crater, we went from the (attempted) civilian use of nuclear weapons to their impacts on civilians in wartime: the Apple-2 site.

Most readers have probably seen the films of anonymous suburban houses decimated by nuclear shockwaves. These well-known newsreels and propaganda films come from a series of atmospheric nuclear detonations at the NNSS that evaluated the survivability of civilian infrastructure. For the most part these civilian infrastructure tests were a secondary purpose of the detonations, which were primarily designed to accommodate military survivability tests out of Desert Rock. Apple-2 was one such test: it was prepared mostly to test methods of protecting military records from nuclear attack. As a secondary purpose, a set of structures were built using different construction methods. Somewhat like the mythical three little pigs (down to involving houses of wood and brick, although no house of straw is evident), the different construction methods were expected to produce a direct comparison of how well common structures could be hardened against nuclear attack.

Some of the Apple-2 structures were destroyed entirely, but two of the houses survive to this day, and we visited one of them. The two-story wood house loomed over us in a dramatic state of decay. While it had survived the blast largely intact, a decision has been made not to actively maintain it despite its historic valuein part to maintain its historic integrity. The heat of the blast burned away most of the paint, and the years have removed the rest. Entry into the house is no longer permitted as its structural integrity has become suspect. Almost no indications of the houses original domestic appearance remain, except a set of sculptural iron details that quite conspicuously remain near the second floor windows. Our guide thinks they were latches for storm shutters, although its hard to tell now.

At the time of the blast the house was fitted with furniture and mannequins, mostly for the purposes of the film that was made of the test. It was also fitted with instruments: pressure and temperature sensors were placed throughout the structure, and today the experimental nature of the house is illustrated by the coaxial cables and hoses that hang out of the walls and ceilings. Near the house some remains of metal posts can be seen, the mounts for the film cameras used during the test. And some distance away, across a road that is unfortunately in too poor of condition for our coach, is the brick house in a similar state of disrepair.

Tests of this type were extensively conducted during the atmospheric testing era. Everything from subdivision houses to electrical substations and telephone lines were constructed in the NNSS to see how theyd hold up to the next test. The resulting information was important in the development of civil defense administration plans, but the idea of hardening residential construction against nuclear attack (for example by the use of 2x6 studs instead of 2x4 and other framing techniques) never really caught on. It wasnt entirely a bad idea, the improved construction techniques really do work. But they also add cost, and the Cold War hysteria of the 60s just didnt persist long enough to see nuclear hardening as a common real estate selling point.

The Apple-2 houses might be the tour stop that has the strongest relationship to the public perception of nuclear testing. The very house we walked around is depicted in the film Operation Cue, a fairly well known piece of Cold War nostalgia. Yet, to be honest, its not all that interesting to me. I am more fascinated by the two concrete-framed but open towers nearby, maybe six stories tall. Our guide tells me that they were built long after the Apple 2 test as part of a research project into earthquake-resistant construction. They wanted to build full-scale structures that could be repeatedly subjected to earthquakes, and no place could offer earthquakes on demand like the NNSS during active underground testing.

Leaving the Apple-2 houses, we pass the T-1 Training Area. This unique facility offers training courses to first responders on radiological detection equipment. These course are made more engaging by the location: ground zero of an atmospheric test. First responders practice handling various radiological emergencies ranging from terrorist attacks to transportation accidents in the background radiation environment of a real nuclear detonation.

To support these training programs, a whimsical array of scenarios are found improbably close together in the barren desert. A derailed train, a crashed airplane, and an abandoned mine are all reconstructed in the space of a few acres. Our guide points out the footings of the original test tower, and tells an anecdote about a satellite imagery enthusiast having once reported their plane crash as a real emergency. This is quite improbable, he points out, because the various broken apart sections of the plane dont even belong to the same model of aircraft. Similarly the derailed boxcars have somehow neatly lost their trucks, and the urban environment is oddly heavy on stacked sea containers. There are affordances to the budget.

Still, this is probably the most complete and realistic radiological emergency training facility available anywhere and the NNSS advertises that over 120,000 people, mostly firefighters, have visited the site since it began operation in 1999.

Emergency response to radiological emergencies is a tricky issue, because the actual scenarios happen quite rarely. We were told that the Department of Energy had been involved in the distribution of a huge amount of radiation survey equipment to fire departments after the Oklahoma City bombing. Shortly after, it was found that most departments had put the boxes they received in a closet and forgotten about them. No one knew how to actually conduct a radiation survey, and so there was little interest in fielding Geiger-Muller counters. The T-1 training complex is one of several facilities the DoE now operates to offer practical experience in locating and assessing radioactive contamination, and this type of training has become much more common for emergency departments nationwide.

On the topic of nuclear counter-terrorism, we also pass by the Radiological Countermeasures Test and Evaluation Complex. At this facility once operated by the Department of Homeland Security, a variety of radiation sources are available to test

detection methods used to prevent nuclear terrorism. As a key example, the Advanced Spectroscopic Portal or ASP system installed at land border crossings was tested for its ability to detect cat litter (naturally slightly radioactive due to its mineral content) in semi-trailers. The main goal of this operation was to determine whether or not the ASP actually lived up to its manufacturers claims for sensitivity.

Of course, our guide notes, the facility was defunded by congress not long after opening and so has been in a mothballed state for some time. One of the key values of American politics is the inability to commit to any program that will independently validate the claims of defense contractors.

As the end of our tour approaches, we head towards Frenchman Flat itself. Frenchman Flat is a large dry lake bed that hosted the first generation of tests at the NNSS. Because it is large, flat, and quite remote, it is attractive for many different types of dangerous or secret tests, and so it is is littered with the remains of many generations of projects.

As we drive onto the flat, our guide points out a number of items in quick succession. Footings of a tower that supported the device for an atmospheric test. A bank vault, installed by its manufacturer to validate their claim that it could survive a nuclear attack. A concrete-frame building with no walls on one side referred to as the hotel, built to test how different types of building wall systems (installed on the open side) would hold up to nuclear war.

One of the more grim aspects of the nuclear weapons program can be seen here: animal testing. Our modern understanding of the effects of radiation on living things (and thus of radiation safety) comes largely from animal testing performed under the auspices of the Department of Energy. At the EPA Farm in the NNSS, cows, horses, pigs, goats, and chickens were all dosed with radiological material to monitor uptake and resulting injury. In Frenchman Flat, there are the remains of pens and cages where farm animals were subjected directly to nuclear detonations.

Some of the cages once held pigs with their eyes sewn open. The eyes of these pigs were later dissected to determine how the initial flash damaged their eyes, and how susceptible humans were to the same blinding. Other pigs were dressed up in various types of clothing and subjected to blasts, to compare how natural and synthetic fabrics affected flash burns.

Animals were not the only form of life that met their dramatic end in Frenchman Flat. At one time, a small forest of Ponderosa Pines was installed in the flat and then destroyed. Modular steel buildings, railroad trusses, metal cylinders, and prototype fallout shelters were all built in Frenchman Flat and many of them survive (in heavily damaged form) to this day.

After the end of atmospheric testing, Frenchman Flat lost much of its utility since surface structures could no longer be directly tested. Instead, a new use was found for the flat: the hazmat spill center. A tank farm was built on the flat to store a variety of dangerous chemicals, and those chemicals can be pumped through a series of pipes to spill out into the open desert. The facility is used to test cleanup and containment methods and protective equipment for hazmat responders. A good portion of the modern methods for management of chlorine spills, for example, were developed or verified here. A wind tunnel and other controlled-environment facilities allow for more complex tests on dispersion behavior. This facility is still in operation today, although it has been renamed the Nonproliferation Test and Evaluation Complex and focuses more and more on counter-terrorism testing.

Frenchman Flat is the last real stop on our tour, and so we head from there back to Mercury and then on to Las Vegas. On the drive from the flat to Mercury, though, our guide points out the collapsed remains of Gravel Gerties. Named after a Dick Tracey character, these structures were designed at Sandia in the 50s to address a difficult but critical problem: how to safely assemble and disassemble nuclear weapons, when the high explosive material and nuclear material were in close proximity. Even though a weapon should never produce a nuclear yield unless properly triggered, there is a great quantity of high explosive in a nuclear weapon and any accidental detonation would scatter the accompanying nuclear material over a wide area.

This was a big problem at the time. In the early days of nuclear weapons, they were stored near Air Force bases with the pits removed. While this was thought to make storage much safer, it necessitated an assembly facility close to each Strategic Air Command base where the pits could be installed and removed when weapons were placed in and out of service [1]. As it happens, the gravel gertie design wasnt used at all weapons storage sites. Instead, early assembly facilities were deep underground (the first two stockpile sites, Manzano Base/Albuquerque and West Fort Hood/Killeen TX). Gravel Gerties did see widespread construction, though, at later SAC installations in the US as well as Atomic Weapons Establishment facilities in the UK. Several remain in use at the Pantex Plant in Texas for assembly and disassembly of weapons.

The design of the gravel gertie is simple but clever: a cylindrical concrete bunker is built with a fabric roof supported by steel cables. Above and around the bunker, a huge amount of gravel (about 7 meters thick by one report) is piled up. In the event of an accidental high explosive detonation, the cables should fail, causing many tons of gravel to collapse into the bunker and cover the radioactive material. This design was thought to be able to contain up to a 1 KT explosion, and at the NNSS at least two were built and tested. Today, that leaves a conspicuous pile of gravel with a few utility poles and chunks of concrete sticking haphazardly out of it. It is reassuring that this ought to be all that remains from a real major accident, although a bit disconcerting that the bodies of the unlucky technicians would probably never be retrieved.

Theres nothing left on the tour now except for the hour or so drive back to Las Vegas. This might be something of a return to normalcy, to the real world, but the Las Vegas Strip is not exactly normal. This series started with the strange contrast between Las Vegas, a globally-known tourist destination, and the NNSS, a little-known site with a history of secrecy. The National Atomic Testing Museum displays this same contrast today, with artifacts of the nuclear testing program displayed alongside posters of a showgirl made up as Miss Atom Bomb.

Las Vegas often feels like it runs mostly on nostalgia for a bygone era. The NNSS has much the same feeling. Posters proclaim that we *are* national security to a staff involved mostly in containing the legacy of national security work. The Welcome to Las Vegas sign provides a grand entrance to almost no one, now positioned much too far south on the strip to see traffic between the airport and the resorts. Our tour guide fondly recounts the era of underground testing while speaking of atmospheric testing like a lost art. At the Flamingo, the showgirls working the casino floor are so sparse that they do more to highlight the disappearance of the form than preserve it.

Ive been playing a lot of *Fallout* lately. *Fallout: New Vegas*, despite its spin-off status, is often considered the best of the series. Perhaps this is simply due to Bethesdas reduced involvement in the development, but I think its at least partially because *New Vegas* is just more deeply rooted in reality than other entrants in the franchise. The nickname Atomic City is no longer common, but Las Vegas itself still

feels like a relic of the Cold War, in ways both good and bad.

Theres some sort of allegory between gambling and nuclear weapons, here. Both destructive, but both oddly seductive. The desert is full of strange and wonderful things.

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[1] I say near each AFB as the weapon repositories were usually technically independent installations, usually built and operated by the Army. This reflects the unusual civilian-military divide in the nuclear weapons complex: while the Air Force used the bombs, they were stored and handled under the auspices of the Atomic Energy Commission, which relied mostly on the Army. Initially these stockpile sites were all managed by civilians, and the Air Force had to request nuclear ordinance on loan. This divide has broken down over the years but is still influential on nuclear bureaucracy.