Section I.B. INL Accident History

Of the 52 reactors built and operated at INL, forty-two (42) reactors melted downed so far in its history of operations. Sixteen (16) of these meltdowns were accidents. The remaining twenty-six (26) were experimental/intentional meltdowns to test reactor design parameters, fuel design, and radiation releases. These nuclear experiments were conducted with little regard to the radiation exposure to workers and surrounding residents. Below is a partial listing of the more notable meltdowns and criticality releases. (See IX Appendix (A)) for a listing of acknowledged melt-downs, accidents, and experimental radioactive releases. The term accidental, used by DOE, is perhaps not an appropriate term any more than when the term is applied to a hot-rodder who "accidentally" crashes his car while speeding at 100 miles per hour down a road designed for 30 mph. Hot-rodding a nuclear reactor just to see what it will take is no accident and no less irresponsible.

According to Boyd Norton, manager of the **SPERT tests** in the early 1960s notes, "These reactors are, essentially, stripped-down "hot-rodders," [sic] they had no radiation shielding and no elaborate safety systems. Sitting as they were, in the middle of more than nine hundred square miles of desert, there wasn't much concern over such things. Not back then." [Norton] See discussion below on SPERT Tests.

An **ICPP/INTEC criticality accident** on October 16, 1959 required evacuation of the facility. "Outside the building and for 130 yards west to the area entrance the radiation field was 5 R/hr or greater." [IDO-10035 @ 4] Thankfully, it was a night shift and less than 10% of the normal work-force was on the site. Twenty-one workers were considered at immediate risk from exposure. Film badge dosimetry and calculations on internal radiation exposure found the highest skin exposure was 50 rem and the highest penetrating exposure was 8 rem. Highest internal dose was 29 mrem. [IDO-10035 @ 5 & 38] This accident followed a Rala run the previous day. [see Section I.D] Over the course of the accident 337,717 Ci of long-lived fission product was released to the atmosphere. [DOE/ID-12119@A-99] See RaLa Run Discussion below.

Another ICPP/INTEC criticality accident on January 25, 1961 released 5,200 Ci [ERDA-1536 @ C-5] and required full evacuation of the plant. Two hundred fifty-one workers were on-site at the time. The highest exposure as determined from film badge readings did not exceed 55 mrem of penetrating radiation. The maximum thermal neutron exposure detected in the 65 badges analyzed was less than 10 mrem. Excessive cesium-138 was detected at the Central Facilities Area three miles south of the INTEC/ICPP after the accident. [IDO-10036@5&6] "Highest personnel exposure received for the four-week period of January 20 through February 16, 1961 by any Phillips' employee in the ICPP at the time of the incident was 240 mrem gamma, 310 mrem beta." [Ibid.@37] Considerable uncertainty exists in relying on the badge reading due to variability in isotope exposure, and the distance the badge is from the worker's hands. More often than not, the badges are considerable understatements of exposure.

For more detailed information see Tami Thatcher's SL-1 report at: http://environmental-defense-institute.org/publications/SL-1Article%20Rev5.pdf

Stationary Low-Power Reactor -1 (SL-1)

The Army and Air Force wanted the Atomic Energy Commission (AEC) to develop a simple reactor that anyone could operate for use in remote areas. They were competing with the Navy dominance over reactor development; how-ever the Navy applied more stringent design/safety/ operating policies for reactors. The early Navy reactors were for submarines, so safety issues were a priority. [1]

The Atomic Energy Commission established the Government Owned/Contractor Operated (GOCO) process for developing nuclear power system. [2] In the case of the Stationary Low-Power Reactor Number One (SL-1), Combustion Engineering located in Windsor, CT, got the contract to build and operate the reactor for the Army at INL.

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[1] Admiral Richover managed the development of the first Naval Nuclear Power Propulsion program at INL's Naval Reactor Facility. See Guide Section I.V.K for NRF details.

[2] See Section I for more info on GOCO

The SL-1 was the Army's attempt to compete with the Navy's dominance over nuclear power reactors. Located at the INL's Auxiliary Reactor Area, the SL-1 was a small compact nuclear power plant designed to generate electricity at remote military locations such as the Arctic or Antarctic.

The reactor served both as an experimental prototype and as a training facility for military personnel. Reactor containment consisted of a grain silo/like building around the reactor vessel; and gravel filled the space between the exterior silo and the reactor vessel that provided some radiation shielding. Access to the top of the reactor was up exterior stairs connected to an operations building connected to the silo containment building.

There are several interpretations of the SL-1 steam explosion accident occurred on January 3, 1961 that will be discuss below. [3] On this bitterly cold afternoon of January 3rd, three Army technicians arrived at the facility for the four to midnight shift. The SL-1 reactor had been shut down for routine maintenance, and the task of the three men that evening was to complete certain preparations for nuclear startup. Since there were no survivors, there are no first-hand testimonies as to what exactly happed that night; and due to the extreme radiation spread around the whole site, forensic evidence is limited.

During the process of attaching control rods to drive motors, one of the men apparently raised the central control rod too far and/or too fast. Evidence indicates that the rod might have stuck momentarily. In the past, there had been significant sticking problems with these rods. When it came unstuck, it moved upward much higher than anticipated and triggered a supercritical power excursion in the reactor core. In a fraction of a second the power reached a magnitude of an estimated several billion watts, melting and perhaps even vaporizing a large part of the core. The water in the core region was vaporized, creating a devastating steam explosion. The remaining water in the reactor vessel was hurled upward at high velocity, striking the underside of the reactor's pressure lid and lifting the whole nine-ton vessel upward, shearing cooling pipes in the process.

The author interviewed Owen Gailar [4] (now 93) who worked at Combustion Engineering Physics Division located in Windsor, CT - where he was in charge of the Reactor Statics Division. The Combustion Engineering (CE) Windsor Engineering Division had control of the SL-1 design, operations, including the SL-1 Physics Group. The CE Windsor Reactor Statics Group (where Gailar worked) had no part in the original SL-1 design and no control over SL-1 operations. Gailar said:

> "Combustion Engineering (CE) that had control of the SL-1 wanted to continue reactor operations. Only Gailar and one other wanted to shut down the reactor" but had no control over SL-1 operations. These significant problems with aluminum clad rods swelling and sticking produced a risk in controlling the reactor and implementing a controlled shutdown."
>
> Gailar said he would "often get 'unofficial calls' from the CE SL-1 Physics Group reporting on loss of boron, critical rod positions and sticking control rods. In this capacity I could 'cross the aisle' and recommend to friends and supervisors in the Engineering Division that the SL-1 be shut down. They in turn did NOT push for SL-1 shutdown! 'You geeks worry about everything, nothing is going to happen,' was the response of mid-level supervisor in the Engineering Department. He [supervisor] was right…for a few months, then 4 were… and not for bureaucratic money grabbing, a fifth would have been killed in the first nuclear power related accident in the United States."
>
> "Combustion Engineering management wanted to continue operations and disregarded its CE Windsor Reactor Statics Group engineer's warnings. These engineers became extremely concerned after they heard that the Army operators were conducting "bumping experiments" or "burp tests" to see how much "steam bubbles" were generated during shutdowns to evaluate the reactor's stability. Also when Reactor Statics Group engineers heard that Combustion Engineering/Army reactor operators were instructed to use a sledge hammer to drive the rods into the core, this raised Gailar and a local physics' concerns. To no avail. Then later when operators tried to remove the rods, they could not manually lift the rods out because they

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[3] "SL-1 Accident Atomic Energy Commission Investigation Board Report Joint Committee on Atomic Energy Congress of the United in States June 1961," now also find it on the INL digital library: https://inldigitallibrary.inl.gov/PRR/70116.pdf or Stanford https://purl.stanford.edu/wx089sc1780

[4] Owen Gailar phone call to Broscious July 2019

had been hammered into place. The operators ask the Army for a jack to lift the rods out far enough (13") to reach the motorized rod lift; but were refused because "it might damage the reactor." [5]

This stability test apparently would be useful to convince the Army that the SL-1 design could be used in remote locations as a power source far away from the usual skilled nuclear reactor engineers. These "bumping experiments" tests are extremely dangerous procedures because the reactor can go out of control in nano-seconds. When reactor operators tried to remove the rods, they could not manually lift the rods out because they had been hammered into place.

The Army SL-1 operators were concerned enough that "they wanted the night supervisor present but were turned down because there were no funds for a night supervisor." One can only speculate that if the night supervisor (normal practice) was also refused; the way the Army and Combustion Engineering were playing loose with an extremely dangerous nuclear reactor operation. Also, this loose safety culture was typical at INL (then known as the National Reactor Testing Station) along most of the other non-Navy reactor operators that ran reactors to deliberate meltdowns to evaluate the various reactor design operating parameters. [6]

"I worked in the CE Windsor physics division, where I was in charge of Reactor Statics. I would often! Get phone calls (Un-official) from SL-1 physics, reporting on loss of Boron, Critical rod positions, and sticking control rods. In this capacity I would "cross the aisle" and recommend to friends and supervisors in the Engineering division that the SL-1 be shut down…They in turn did NOT push for SL-1 SHUTDOWN!"

This is informative and helps explain the motive for continuing to blame the crew for the SL-1 accident, to protect Combustion Engineering as well as the AEC which was in charge of safety. Of the three crewmen at SL-1, it is agreed that there were probably two crewmen on top and a third on the floor. Crewman McKinley was the one man on the main floor when the accident happened and another was thrown from near the reactor top. They both died of blunt force trauma. The third man was eviscerated and impaled to the ceiling. According to Tami Thatcher's investigation;

"According to Todd Tucker in his book Atomic America about the SL1 accident, Clarence Lushbaugh from Los Alamos National Laboratory was the pathologist brought in to examine the SL1 crewmen. The bodies of the men had been quite mutilated and this has caused problems in identifying the men. Crewman McKinley had been on the reactor main floor and he is the one who was still alive for a few hours. There are different opinions about exactly where each man was when the accident happened, but Lushbaugh's reconstruction of their positions was based on his examination of the bodies. Lushbaugh placed crewman Legg on the reactor top with his hands-on Rod 9, with crewman Byrnes standing nearby to assist with reassembly of the control rod drive. Crewman Legg's hands were greatly injured; crewman Byrnes' hands were not. Crewman Legg was impaled to the ceiling by the Rod 7 shield plug. But the early blame was on crewman Byrnes, who was having marital problems, as having deliberately pulled the rod and the evidence to the contrary was available to few. The men died of blunt force trauma (page 176 of Atomic America), although they would have died of neutron exposure or radiation dose had they not died of blunt force trauma.

"In William McKeown's book Idaho Falls *The Untold Story of America's First Nuclear Accident*, on page 128, he provides a figure showing the radiation survey of the three crewman, after decontamination efforts. But the identities corresponding to the three figures gets misidentified in the book.

"So, in addition to the immediate deaths of two crewmen, and the death of a third crewman about two hours after the accident, this comment adds a fourth person as the nurse, Hele Lesien, who was in the ambulance that the crewman was put in, while still alive. The nurse was not wearing a radiation badge but the door of the ambulance was surveyed at 400 R/hr., [page 87], *Atomic America*. So, the radiation level inside the ambulance with the crewman was higher and the nurse was in the ambulance with the crewman, McKinley, for a period of time between 10:35 when the victim was heard moaning on the reactor floor and

[5] Owen Gailar written comments to Broscious on EDI Guide to INL excerpts

[6] Owen Gailar written comments to Broscious on EDI Guide to INL excerpts

> 11:14 pm when this victim, McKinley was declared dead while inside the ambulance. There is no doubt that the nurse received a life-shortening radiation dose and she died of cancer a few years later.
>
> "But, many of the SL-1 responders died of cancer. The difficulty is in documentation of the number of years after the accident that they died and in their diagnosis. So, we continue to distinguish the three deaths the evening of the SL1 accident from deaths that occurred years later of emergency responders. And we maintain that many cleanup workers obtained early deaths from the inadequate radiation monitoring during cleanup.
>
> "It is correct, based on Energy Employee Occupational Illness Compensation which has paid out billions of dollars. There are many more claims denied than compensated and so the number of workers having disease from radiation is disputed. I also found that 1200 workers participated with SL1 cleanup.
>
> "Operators ask for a jack to lift the rods out far enough (13 in.) to reach motorized rod lift, which although refused by the Army because they felt it might damage the reactor, was an indication of serious rod sticking at the SL-1 reactor.
>
> "See the AEC Investigation Review Board report, p. 7 that describes that Combustion Engineering requested written confirmation that a Combustion Engineering shift supervisor would not be required for routine supervision of night shifts. Thus, three crewmen were to work alone at the facility during the evening shift, which would leave no one at the control room to monitor instruments and no one to observe the work being conducted." [7]

Four workers (3 reactor operators and 1 nurse that transported one of the fatally injured operators) were the initial causalities in the SL-1 explosion. In addition to the nurse's death from radiation exposure, about a dozen other emergency responders that night may have died of cancer years later; this is described somewhat in books about SL-1.

According to Boyd Norton; "The three men, who had been standing atop or near the reactor vessel, were killed by the explosion that lifted the vessel 8 ft. before the huge vessel dropped back into place. One of the men remained impaled on the ceiling by a piece of control rod rammed through his groin. 'It all happened in a second or so.'"

"It [SL-1] was a terrible accident, made even more grisly because the intensely radioactive fission products scattered inside the building by the accident hampered the work of recovering the bodies. Staying in the building for mere seconds resulted in a year's allowable dose of radiation for rescue workers. And it took six days to remove the body that was impaled on the ceiling by use of a remotely operated crane and a closed-circuit television. The bodies were so badly contaminated, the heads and hands of the victims had to be severed and buried with other radioactive wastes at the Radioactive Waste Management Complex." [Norton] The Oil Chemical and Atomic Workers Union protested vigorously that the government refused to provide a proper Christian burial for the workers." [8]

The SL-1 reactor explosion not only resulted in three operator deaths but also serious exposure of 0.1-0.5 roentgens [rem] to nearly 100 personnel. Over 12 workers received exposure greater than 10 roentgens [rem]. [IDO-19301@138] The maximum acknowledged personnel exposure was 1,000 R/hr. (Rad per hour). [ERDA-1536, p.II-243] The exposed reactor was still emitting 22,000 R/hr. five months after the accident. Readings above the reactor one month after the accident were 410 R/hr. [IDO-19301, p.109] 1,128 Ci including 80 Curies of radioactive Iodine were also released during the SL-1 accident. [ERDA-1536, p.II-243] [DOE/ID-12119@A-53] A temperature inversion kept the radiation plume close to the ground and at 25 miles the radioactive iodine levels were 10 times above background. At 100 miles the radiation levels were above background.

The author interviewed the widow of James Dennis who was a member of the SL-1 **in-**voluntary Army demolition crew brought in to dismantle the reactor after the accident. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia, which his medical documents confirm, was

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[7] Tami Thatcher review of Owen Gailar's comments on SL-1 October 2019.

[8] Norton; "Supercritical", Boyd Norton, Manager of SPERT Reactor tests during 1960s, Audubon Magazine May 1980, p. 89-105]

caused by exposure to 50 rem/hr. for nine hours and ten minutes at the SL-1 site. [Dennis, p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1, CAB] as grossly understated. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis, p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Dennis is only one of thousands of individuals who are victims of the health effects of radiation exposure caused by radioactive releases from DOE facilities.

Tami Thatcher's extensive SL-1 document review relating to the reactor rod prompt critical height found:

> "The reading the IDO 19311b, page III-107, shows that this later prediction puts prompt critical at 17.6 inches. Not 20 inches, as the first Combustion Engineering report states. Also page III-51: "For shroud No. 1, the control blade for No. 1 extended 4 inches below the bottom of the shroud." [Note that for the center blade, it extended much further] Anyway, it says "prominent rub marks can be plainly seen on the lower section of the exposed part of the blade . . . and these marks are of pre-incident origin." 9
>
> "And in this IDO 19311b report, they mention finding on the center blade "many scouring marks that appears to be of pre-incident origin..." [p. III-62] Now, this is significant --- the lower end of the control rods would exit the shroud. And would apparently warp as it sat during shutdown – so this solves a problem for me – It seemed to unlikely that it would glide, not sticking – and then have debris and be stuck. Sticking as the lower end entered the shroud! And not much discussion of where the scouring marks is exactly despite the importance. But I can't see the black and white pictures very well.
>
> "The center control rod had to be moved 2 inches and could have been moved 3 inches with the c-clamp, then needed to be lifted, slightly – it stuck. They concede that a man can over lift by 10 inches. So this is 10 + 3 = 13 inches. And now we're saying prompt critical at 17.6 inches. An extra 4.6 inches! Jerking free a rod!
>
> "The rods were sticking in this low position, as the lower end was coming in the shroud. This matters! In this town – it matters! Because of how "Proving the Principle" is written – and the DOE films ---- Proving the Principle says the rod was withdrawn 26 ¼ inches (p. 148)! IT WAS NOT! So insinuate that it had to be a deliberate act. Most folks around here think that --- and the Idaho Falls – the untold story is so excellent is some ways but it really leaves it as a mystery.
>
> "Like the scratches on the control rod that happened after the explosion – that some folks concluded meant that the control rod had been yanked out. At least "Proving the Principle" concedes the scratches happened after the rod hit the ceiling." Below is a list of Tami Thatcher's extensive published reviews of the available declassified reports on the SL-1 explosion.
>
> Tami Thatcher, Environmental Defense Institute, The SL-1 Accident Consequences, September 2019. http://environmental-defense-institute.org/publications/SL-1Consequences.pdf
>
> Tami Thatcher, Environmental Defense Institute, The Truth about the SL-1 Accident – Understanding the Reactor Excursion and Safety Problems at SL-1, Updated September 2019. http://environmental-defense-institute.org/publications/SL-1Accident.pdf
>
> Tami Thatcher, Environmental Defense Institute, A Brief History of Radiation Exposures to Idaho National Laboratory Workers, Updated January 5, 2016. http://www.environmental-defense-institute.org/publications/TopTenINLR2.pdf
>
> Tami Thatcher, Environmental Defense Institute January 2015 Newsletter article, America's only Nuclear Reactor Operator Deaths. http://www.environmental-defense-institute.org/publications/News.15.Jan.Final.pdf
>
> Tami Thatcher, Environmental Defense Institute April 2018 Newsletter article, "An Editorial About the

[9] Atomic Energy Commission report, Idaho Field Office IDO-19300, "SL-1 Reactor Accident on January 3, 1961: Interim Report." Combustion Engineering, May15, 1961 and Atomic Energy Commission report, Idaho Field Office, IDO-19311, "Final Report of the SL-1 Recovery Operation, General Electric Co., June 27, 1962 partial center rod withdrawal of 20 inches, p. 146.

1961 SL-1Accident History in Response to a February Guest Editorial in the Post Register." http://environmental-defense-institute.org/publications/News.18.April.pdf

INL Managers Deny Any Responsibility for ZPPR Accident (By Tami Thatcher)

"A recent article in the Boise Weekly about the 2011 Zero Power Physics Reactor (ZPPR) accident at the Idaho National Laboratory's Materials and Fuels Complex (MFC) included interviews of INL managers.[10]

"The ZPPR accident contaminated workers with plutonium when damaged fuel plates were exposed. The DOE accident investigation report[11] concluded that the accident was preventable and that the safety chairman for MFC had twice given written information about his concerns about the continued use of the hood and the higher likelihood of finding damaged ZPPR plates.

"The Department of Energy accident investigation report stated that "Battelle Energy Alliance (BEA) continued operation of the ZPPR Facility with known safety basis deficiencies and without adequately analyzing the hazard to the worker."

"Interviewed for the Boise Weekly, Phil Breidenbach recalls the meeting with the safety oversight chair as cordial and soft-spoken. "This letter, when it's looked at outside the context of what goes on here every day, creates the image that someone ran in here and said, 'No, stop, danger, danger, danger.'" John Grossenbacher said. "That's not the case."

"DOE and its contractors should take note: all safety issues of *actual* importance require the person describing it to say "Stop" and then say "danger, danger, danger" at least three times.

"Breidenbach said one simple action could have prevented the exposure: Ralph Stanton and others could have stopped the work once they found the plastic-wrapped plate. "I'm not a rocket scientist or a Ph.D.," Grossenbacher added, "but if I'm a rad-con tech and I think, 'Well, what happens to this stuff after 30 years of being wrapped in plastic, anybody know?' And if the answer is no, I would say, 'You know what, let's stop.'"

"These two INL managers have forgotten the DOE accident investigation report that describes Stanton and others who questioned several times whether to proceed and it describes the operations personnel including the facility manager – who confidently directed that the work proceed. They have also forgotten the finding that BEA management failed to report the Safety Chair's findings as an Unreviewed Safety Question." [12] [13]

"Breidenbach said, "the stars aligned in such a way that too much equipment was out of service." But, BEA had problems far beyond the work room's ventilation and inadequate alpha alarm placement.

"For INL managers who had been briefed on the safety problem but never acted on it, never bothered to find out if operations people understood the increased risk, never questioned whether the controls were adequate – for them to state that it was the fault of the rad-con techs reflects an uncorrectable mentality.

"Grossenbacher also said that when it comes to the health effects of plutonium inhalation: "We know what kind of radiation exposures will result in physical impacts on a person's health, and none of these exposures came anywhere near that."

"The problem is that estimated doses have are large uncertainties and questionable cancer risk

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[10] Article by Jessica Murri, "Half-Life: How an Accident at the Idaho National Laboratory Changed a Family," *Boise Weekly*, —April 2014. http://www.boiseweekly.com/boise/half-life-how-an-accident-at-the-idaho-national-laboratory-changed-a-family/Content?oid=3094301&showFullText=true

[11] Department of Energy, Office of Health, Safety and Security (HSS), Accident Investigation Report, "Plutonium Contamination in Zero Power Physics Reactor Facility (ZPPR) at the Idaho National Laboratory" accident 11/8/11 at the Materials and Fuels Complex (MFC). http://energy.gov/hss/downloads/investigation-november-8-2011-plutonium-contamination-zero-power-physics-reactor.

[12] DOE Occurrence Report NE-ID-BEA-ZPPR-2011-0001 https://orpspublic.hss.doe.gov/orps/reports/displayReport2.asp?crypt=%87%C3%95%9Ba%8Etjz%5D%91

[13] See the October 2013 EDI newsletter article about ZPPR: http://www.environmental-defense-institute.org/publications/News.13.Oct.-Final.2.pdf

prediction adequacy.[14]

"I would also like to remind Grossenbacher that the Energy worker compensation act (EEOICPA) points out that "studies indicate than 98 percent of radiation-induced cancers within the nuclear weapons complex have occurred at dose levels below existing maximum safe thresholds." [15]

Accident at INL Leads to MFC Worker Complaint

Alex Stuckey reports 8/11/13 in the Idaho Falls Post Register: "Ralph Stanton slowly sliced through the plastic and electrical tape wrapped around a plutonium fuel plate.

From above the hood, he watched his gloved hands work over the plate, found in a box -- called a clamshell -- atypically labeled with warnings about radioactive contents and abnormalities in the fuel plate's conditions.

Just minutes before, he and his co-workers conferred with their immediate supervisor about opening this and another atypical clamshell. Their supervisor gave them the go-ahead to cut through the plastic. An operator also asked what to do in the event of a fire or powder sighting. The operator said he was told that was "not a valid question," but the supervisor does not recall this, according to the January 2012 Department of Energy Accident Investigation report.

Stanton slowly turned the plate over. Black powder, plutonium, spilled out. No respirator protection was worn, the report stated.

At 11:04 a.m. Nov. 8, 2011 -- in the building that once housed the Zero Power Physics Reactor on the Department of Energy's desert site -- Stanton and 15 others were exposed to the plutonium.

The aftermath of the accident -- and the decisions made by Battelle Energy Alliance leading up to it -- led Stanton and a colleague, Brian Simmons, to file a whistle-blower complaint against the contractor in charge of Idaho National Laboratory.

The DOE report concluded the seeds of the accident were planted years before it occurred. They included: On June 23, 2011: A safety official presented a document to management containing recommendations for safe handling of fuel plates stored at the reactor building, the second time since 2009. Both times, the document's "significance was not recognized and no action was taken," according to the report.

On Around 2004-2005 -- about the time BEA was awarded the 10-year contract to manage INL -- information containing the condition of the fuel plates -- some of which were stored for 30 years in the reactor building -- was lost.

But at 11:04 a.m., Stanton was not aware of these issues. He was only aware of the hand- and foot-monitor alarm and the jittery feeling forming a lump in his throat.

At 11:07, the Vault Continuous Air Monitor, which measures near real-time gross radioactivity levels, went off. The workers evacuated the room and were ushered into the reactor control room, the report stated. Later, the DOE would find that the location of the monitor was not optimal for work performed in the hood.

Nearly 20 people sat in the control room in total silence as a worker read off the escalating monitor numbers, Stanton said. Scanning the room, he said he could see the worry on everyone's face.

That's when the severity hit him. Stanton's new life of uncertainty started that day, but he was hopeful for assistance from BEA or the DOE. He said it hasn't come. BEA officials declined to comment.

He hopes his whistle-blower complaint filed in April will change that. He and Simmons allege the contractor created an unsafe work environment and then retaliated against them after they raised health and safety concerns regarding the incident. Simmons did not wish to speak on the record.

In previous Post Register reporting, BEA has said it disagrees with the filed complaint and "will be strongly defending."

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[14] December 2013 EDI Newsletter article, "How Believable are Estimated Radiological Doses Following Plutonium Inhalation?" by Tami Thatcher. http://www.environmental-defense-institute.org/publications/News.13.Dec.Final..pdf

[15] 42 USC 7384, The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA), as Amended.

On two occasions in 2011, BEA allegedly refused to allow Stanton and Simmons to use lead shielding to protect themselves when handling plutonium, according to the complaint. The two workers "exercised their rights to stop the jobs," according to the complaint.

In October 2011, Stanton and Simmons allegedly were asked to "falsify 25 Type 1 safety procedures on a job that was done the day before." They refused, the complaint said.

In retaliation for the two workers' actions, the complaint alleges, BEA sent them to a psychologist for evaluation, gave them negative performance evaluations and withheld radiation dosage information.

The Department of Labor has a year to investigate the case and report a resolution. "I know it costs a little money to keep us safe, but let's do it," Stanton said.