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Estimating ICPP Source Terms at INEEL

The INEEL (now called INL) Health Effects Sub-committee (IHES) issued a recommendation to the Centers for Disease Control (CDC) to conduct a source term review of the INEEL RaLa Runs. At the last IHES meeting in June CDC officials indicated that they were moving forward with a RaLa Review and offered an outline of the methodology CDC intended to implement. Specifically, CDC intends to utilize DOE's stack monitoring data to quantify the source terms (what contaminates were released, how much was released and when they were released). Before launching into a discussion on this INEEL process, it is useful to review the Hanford Environmental Dose Reconstruction (HEDR) process and identify lessons learned by the public.

HEDR Source Terms

Numerous major mistakes were made and continue to be made by CDC in the HEDR process to establish radiation doses to the effected public from the emissions from Hanford. Since HEDR started some six years before the INEEL Dose Reconstruction Study, there are lessons to be learned so as to avoid repeating the same mistakes at INEEL and further undermining CDC credibility and wasting tens of millions of dollars of public resources.

Initially, HEDR's focus was on Hanford's startup of its plutonium processing plants in 1944 through 1947. This period is generally called the "Green Runs" because Hanford was processing fuel shortly after it was removed from the reactor and before it cooled in water pools allowing short-lived fission products like Iodine-131 to decay. HEDR estimated in the late 1980's that approximately 441,700 curies of I-131 was released between 1944 and 1947. This estimate was based on declassified stack monitoring documents released in a Freedom of Information Act request. Few people outside DOE and CDC believed these estimates because they were based on questionable data. Finally, years later, after significant public pressure, CDC sponsored a physical reconstruction of the Green Run period between 1944 and 1947. The 1992 revised estimate increased to 685,000 curies of I-131 released between 1944 and 1947. The key elements of the data needed for a physical reconstruction were:

1.) Cooling time of the fuel processed. Short cooling periods of hours or days rather than months means that short-lived isotope inventories such as I-131 will be much higher in the fuel.
2.) Release fractions. This figure is based on how much of the iodine present in the fuel is released to the environment. For Iodine-131, HEDR calculated the release fraction to be 90.5%.
3.) Reactor power levels of fuel used. A direct relationship exists between the reactor power level and the isotopes created in the fuel. The higher the power level, the more Iodine-131 is generated. [TSP News letter, 12/92]
4.) Fuel type and percentage U-235/Pu-239 enrichment.
5.) Emission control systems accurately factored through the chronological history of the plant.

The partial physical reconstruction (1944 to 1947) was not extended to the 1948 to 1960 period, though HEDR estimates Iodine-131 releases between 1944 to 1960 at about 738,700 curies which produced a 870 rad exposure to an infant born in Ringold, WA in 1943 or 1944. [Connections(a)]

While working on the Hanford Downwinders class-action lawsuit, Owen Hoffman, President of the SENES Oak Ridge Center for Risk analysis, determined that approximately 900,000 curies of Iodine-131 were released by the AEC's Hanford plants between 1944 and 1957, a period including the Hanford "Green Runs." This amount is 150,000 curies more than the "official" estimates from the Centers for Disease Control. Hoffman's review focused primarily on the period between 1951 and 1960 because HEDR did not extend the thorough physical reconstruction into this period. He concludes that "the estimates of releases presented...for this period clearly represent severe underestimates of the actual releases."[i] Hoffman also notes that HEDR attempted to attribute emission control systems to processing plants many years before they were installed, thus underestimating the releases. This chronological error was also made with CDC's INEEL Phase-1 Report generated by Sanford Cohen & Associates despite protests by this author, and no attempt has yet been made to correct the errors.

INEEL RaLa Run Review

As of this writing, CDC apparently refuses to do a physical reconstruction of the INEEL RaLa Runs as part of the INEEL Dose Reconstruction Health Study. CDC is opting for the use of discredited DOE stack monitoring data. This is another deliberate attempt by CDC to understate the radiation release estimates in the hope that the government's liability exposure will be minimized. There are extremely important "lessons learned" from the Hanford studies that the public justifiably wants applied to the INEEL studies.

Documents relating to Hanford production reactors gained by the Environmental Defense Institute through Freedom of Information Act (FOIA) requests shows the elaborate logistical arrangement required for the RaLa Runs at the ICPP. "The short half-life of the RaLa product has important effects on RaLa procedure. Due to its rapid decay rate, Ba-140 concentration approaches saturation in "green metal" soon after the metal is charged in the reactor. For this reason metal shipped as RaLa is normally "green" metal charged on the last outage previous to the RaLa shipment. Due to the short half life of the RaLa product, rapid handling and processing of the discharged material is imperative. Once a reactor is shutdown and metal is discharged for the RaLa program, this material must be shipped, processed, and forwarded to its destination as quickly as possible so as to minimize product depletion due to decay. For the same reason, the dates and times of the RaLa shutdowns are routinely adjusted to shipping schedules." [ii]

Other Hanford documents quantify the amount of irradiated uranium slugs shipped to ICPP. For instance one report notes that between 11/54 and 4/56 200,000 J and C Slugs were shipped from Hanford to ICPP for processing.[iii] Other reports put the shipping rates at 22 kilograms per month.[iv] The point in emphasizing in this discussion the extensive involvement of the Hanford reactors in providing ICPP throughput, is to demonstrate the importance of this information in developing ICPP source terms via a physical reconstruction. To date, CDC is not showing any interest in utilizing this crucial information.

Both INEEL and Hanford were reprocessing green reactor fuel using sodium hydroxide as a "caustic" to dissolve the fuel and chemically separate the uranium and plutonium. In the case of the INEEL RaLa Runs, lanthanum-140 or its decay product barium-140 was the production focus. At both sites there was little or no emission control systems in place to filter out the fission products like I-131 released to the atmosphere. "During this time, there no filters on the stacks of the separations plants. Radioactive materials in the form of gases, vapor, and particles went up the stacks. The separations process primarily released large amounts of iodine-131, ruthenium-106 and ruthenium-103 along with other radioactive substances. Two radioactive gases emitted in the separations process, krypton-85 and xenon-133, contribute to radiation dose of a person stands in a 'cloud' of the gases. Plutonium is also known to have traveled off-site." [v]

Because these other isotopes (besides I-131) contribute significantly to the dose, they must be included in the INEEL source terms at the Idaho Chemical Processing Plant (ICPP) now called INTEC. The RaLa Runs must also **NOT** be the sole focus of ICPP source terms, but rather one of many separations campaigns. Therefore, the entire ICPP throughput must be subjected to a full physical reconstruction. Just as important, is the high-level liquid waste Calciner incinerator and other high-level waste evaporators must be included in the ICPP source terms. The first Waste Calcine Facility came on line in 1963 and ran through 1981 incinerating more than 4 million gallons of high-level waste. The New Waste Calcine Facility (NWCF) operated between 1982 and 2000 incinerating an additional 4 million gallons of high-level liquid waste.[vi] Both Calciners never received the required RCRA hazardous waste permits because they could not meet emission standards.

Again, ICPP stack monitoring data is unreliable and must not be used in source term estimation. To further illustrate this point, Environmental Defense Institute, Keep Yellowstone Nuclear Free, and David McCoy have copies of internal INEEL reports gained through a Public Information Request, that acknowledge as late as 1996 that the required ICPP stack monitors were either non-existent or were turned off. This document further acknowledges that DOE is in violation of the Clean Air Act (NESHAP) regulations. [vii] DOE generates emission release documents based largely on "process knowledge" estimates, not on actual instrument monitoring data and is therefore unreliable not to mention illegal.

CDC is defending its resistance to a full physical reconstruction at INEEL, by characterizing it as only a "screening" process to determine if the RaLa Runs deserve additional study. CDC, in the past, forgot that "screening reviews " were quick and dirty reviews and later called them credible source terms studies in the hopes that no one remembers the applied methodology. The public demands credible science from CDC, and the agency must understand that we will not suffer through the same bogus process demonstrated at Hanford.

CDC's INEEL Document Data Base

CDC's Phase-I document data base and the more recent RAC Task Order 6 database posted on the agency website was randomly checked for Hanford documents related to the INEEL RaLa Runs and other ICPP fuel reprocessing. None were found using the website search engine. Even Dr. Till's instructions to look for MC- 71617 and MC-71618 documents, the search came up empty. This is yet another indication that information base for the INEEL Dose Reconstruction Study remains deficient.

Document Destruction

The issue of INEEL document destruction is at the crisis point. The recently released CDC status report on documents relevant to the INEEL Dose Reconstruction Study reveals that some 1,254 boxes of documents have been destroyed or are otherwise missing. A single box could hold 5,000 pages, so the total loss of information could be in excess of 6 million pages. One of the issues is the CDC's document classification system of Pertinence 1, 2, 3, and 9 in descending order of relative importance to the INEEL Dose Reconstruction Study. To illustrate the problem, let us use the example of the previously discussed need for a physical reconstruction of ICPP source terms. Since CDC never intended to do a physical reconstruction of the ICPP, documents related to reactor power level, cooling time, emission control systems would not be considered a high priority (pertinence 1 or 2) document. CDC's delays of over eight years to conclude its Phase -1 document review has given DOE ample opportunity to destroy incriminating evidence. The problem is so acute, that it is uncertain that a credible study can be done even if CDC suddenly found the political will to do good science. The same problem will be faced by independent researchers working on a future INEEL class action suit, because the essential information simply may no longer exist. CDC additionally failed to secure documents once identified so that they would be later available for use in the health study. That is like farmer Brown telling the fox which chickens are the fat ones and which roost they are on before turning over the keys to the fox to guard the chicken coop.

The report was written by Chuck Broscious, Executive Director of EDI. For more information on the RaLa Runs and the ICPP releases see our *Citizens Guide to INEEL*
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Endnotes:

[i]Hoffman, F. Owen, *Evaluation of the HEDR Source Term and HTDS Power Calculations*, SENES Oak Ridge Inc., Center for Risk Analysis, March 1999. Also see email from Hoffman to Broscious 9/6/00. Hoffman adds, stack monitoring data can be fraught with uncertainty, especially if the samplers are inefficient and not isokinetic. I agree, the releases should best be based on process level modeling followed by environmental sampling of I-129 (to confirm the release fractions). Was RaLa the only source of I-131 releases at INEEL? At Oak Ridge it may not have been. I now think that the total releases of I-131 were underestimated at Oak Ridge. At INEEL, the public health implications of exposure to releases of I-131 must consider the combined exposures to I-131 in Nevada Test Site and global fallout as well. In fact, worker exposures and risks should be considered along with those residing offsite.

[ii] Scheduling RaLa Shipments, July 30, 1954, General Electric Company, Hanford Atomic Products Operation. HW-32594, HAN-56557

[iii] See HAN 53823

[iv] See HAN -52865

[v] Hanford Health Information Network, *The Release of Radioactive Materials from Hanford: 1944- 1972*, April 1993

[vi] Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement December 1999, Vol. 4, C.9-11.

[vii] DOE Notegram, July 25, 1996, to C. L. Tellez, from M. E. Feldman and T. A. Solle, Subject "Air " Legacy Issues