Waste Management at DOE Accelerator Facilities: Challenges and Opportunities

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SLAC

ES&H SLAC environment, safety & health

Waste Categories

- Sanitary Waste
  - General office or construction waste with no hazard characteristics.
- Non-Radiological Hazardous Waste
  - Waste with no radiological component by is otherwise hazardous under OSHA (or state equivalent) regulations.
- Radioactive Waste
  - Airborne and Aqueous Effluents, and Induced-Radioactivity in Groundwater (managed by the Radiological Environmental Protection Program at SLAC).
  - Low-Level Radioactive Waste (LLRW).
  - Low-Level Mixed Waste (LLMW).
  - California Combined Waste (CCW); for accelerators in The Golden State.
  - DOE-defined special-case wastes:
    - DOE 'Moratorium' Scrap Metals (a/k/a 'Return on Investment (ROI)' metals).
    - DOE 'Suspension' Scrap Metals.

Sanitary Waste

- Usually the largest volumes of waste categories.
- Costs for disposal are cheapest per unit volume or mass for accelerator waste categories.
- However, disposal costs are increasing.
- DOE is showing growing interest in adding sanitary waste management as part of laboratory performance measures.
- As a consequence, recycling is becoming more practical for sanitary waste.

Non-Radiological Hazardous Waste

- Generally the largest waste category program at DOE Labs.
- Hazardous waste management programs are heavily regulated from the federal government on down to local county and city hazardous waste regulatory agencies.
- As a result, management costs are relatively expensive.
  - Collection, packaging, labeling, and tracking are high cost factors.
  - Staffing tends to be large from necessity.
  - Onsite 90-day EPA-hazwaste storage limit, if one's DOE lab is held rigidly to this limit.
  - Such waste must be disposed in hazardous waste landfills, which is more expensive than sanitary landfills.
- Recycling can be a valuable tool, but is experiencing diminished returns, as DOE labs find that the only recycling available to them is to swap their hazwaste in return for other labs' similar waste, thereby gaining nothing overall for the DOE complex.

Radioactive Wastes

- LLRW and LLMW:
  - Highest costs per unit volume or mass of collection, processing, packaging, inventory control, shipping, and disposal of all waste categories.
  - Regulatory aggressiveness tends to drive administrative costs ever higher.
  - Relentless antinuclear activism has been successful in eliminating most available disposal options for LLRW. LLMW requires treatment before it can be disposed; treatment permits from the EPA are prohibitively expensive to obtain and to utilize (greater NESHAPs impacts, etc).
  - Antinuclear activism also has thwarted efforts to establish a national 'below-regulatory-concern' option for free-release of insignificant radioactive wastes.
  - The Federal Facilities Compliance Act allowed a one-time-only option to establish an onsite storage capability for LLMW for greater than 90 days. Those labs that did not exercise that option now face ever-increasing 90-day storage limit challenges, on top of everything else.

Typical LLMW Types and Forms

- The following are common hazardous materials found at SLAC and if radioactive (i.e., activated and/or radioactively contaminated) may classify it as a mixed waste. (This is not an all-inclusive list.)
- Acids/Bases
- Asbestos (e.g. gaskets, insulation, building materials: floor/ceiling tiles, sheet linoleum, shingles, etc.)
- Batteries (e.g., dry cell, lithium, wet cell, lead/acid, nickel/cadmium)
- Brass, bronze
- Chemicals
- Degreasers/Solvents/Cleaners (e.g. alcohol, trichloroethane, etc.)
- Fuels (e.g., diesel, gasoline; includes filters, etc.)
- Lead (e.g., shielding, brass, bronze, solder, circuit boards, paint, batteries, etc.)
- Lubricants
- Mercury (e.g., batteries, switches, thermometers, fluorescent lights)
- Oil/Grease (e.g., oil filters, oil contaminated rags/cloths, oily water, oily solids, motors, bearings)
- Paint, Painted Items, Paint chips, Paint Thinner
- Poly Chlorinated Biphenyls, PCBs
- Rust Inhibitors
- Solders or equipment with lead solder
- Any item containing or exposed to the hazardous materials identified above (e.g. rags, absorbents, containers, etc.).
- Any item displaying one of the following characteristics: Corrosivity, Ignitability, Reactivity, or Toxicity.
- Any item containing one or more of the following toxic metals:

  Antimony* Arsenic Barium Beryllium* Cadmium Chromium Cobalt*
  Copper* Lead Mercury Molybdenum* Nickel* Selenium Silver
  Thallium* Vanadium* Zinc*

  (*Potentially hazardous if in a friable, powdered, or finely divided state.)

Any of these all-too-common types & forms of waste, once it becomes LLMW, can wreck your budget!

Radioactive Wastes

- California Combined Waste (CCW):
  - CCW is LLRW in California that has one or more characteristic constituent that is a ‘hazard’ under California law but not under RCRA.
  - In such a case including for DOE labs in other states, there is a potential time-and-money saving opportunity to store such waste onsite for longer than 90 days.
    - For example, SLAC has utilized as a ‘silent partner’ a MOU between California and LLBL and LLNL to allow CCW to be stored onsite longer than 90 days.

DOE Moratorium Metals (ROI)

- The ROI program allowed restricted release of mildly-radioactive metals into the public for use in infrastructure (bridges, etc.)
- The ROI program was halted abruptly on 01/12/2000 via Secretarial Order.
- The ROI program was ordered not to resume until a PEIS was completed.
- To date, the PEIS has not been completed.
- Consequently, ROI metals must be stored, recycled between DOE Facilities, or be disposed as LLRW, at least until the PEIS is completed.
- Antinuclear activism is preventing PEIS progress.

Effect of the January 2000 DOE Metals Release Moratorium at SLAC

- 125 tons of non-radioactive scrap metal generated under the erstwhile Return On Investment (ROI) program were snared by the moratorium shortly before final approval for their release was anticipated.

125 tons of ROI metals awaiting release

DOE Suspension Metals

- On 07/13/2000, another DOE Secretarial Order mandated that no metals that were inside a Radiological Area on or after that date could be freely released, even if they were not radioactive.
- This suspension is to remain in place until a procedure is developed to help ensure that such metals are not volumetrically-radioactive. The 'public' (including any opponents who wish to get involved) must be involved in vetting the procedure.
- No DOE lab has yet to develop a successful procedure.
- Without a procedure, options left to DOE labs include:
  - disposal in a municipal, Class I, or Class II landfill,
  - disposal as low-level radioactive waste,
  - hold onsite at until either the Suspension is lifted or a new recycling opportunity within DOE emerges, and
  - hold offsite at a third-party storage facility.
- None of these options offer a clean 'out' for the Suspension problem.
- Storage costs keep climbing while available space keeps shrinking.
- Suspension metals continue to accumulating at DOE labs, producing sights like this:

Non-Radioactive Scrap Metals Currently Stored at SLAC per 07/13/2000 DOE Metals Suspension

Current onsite inventory: ~27,000 ft^3 of pipes, frames, girders, magnets, etc.

Physical breakdown of constituent metals:

- **77% steel/iron**
- **15% aluminum**
- **5% stainless steel**
- **2% copper**
- **1% electronics**

Covered-storage capacity for larger objects is exhausted. The excess items are being stored outdoors; see photos of examples here:

We know the challenges…. What should be our strategy?

- Minimize generation of all categories of waste…
  - better training of waste generators.
  - institute disposal chargebacks to the generators.
  - Build in decommissioning waste cost set-asides during new project planning.
- Advocate DOE to establish more LLRW disposal sites and LLMW treatment facilities.
- Lift the DOE Metals' Moratorium and Suspension.
- Push for establishment of a BRC option, and
- Encourage DOE to oppose antinuclear activists from Washington to the State Houses.