ACHIEVING READINESS FOR A NEW RCRA PERMITTED, NUCLEAR FACILITY, EXPERIENCED GAINED AT THE DECONTAMINATION AND WASTE TREATMENT FACILITY AT LAWRENCE LIVERMORE NATIONAL LABORATORY

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ABSTRACT

The DWTF (Decontamination and Waste Treatment Facility) is a facility built in Lawrence Livermore National Laboratory, a University of California operated, government owned, DOE, (Department of Energy) National Laboratory. The DWTF is a facility built to manage LLW (Low-Level Waste), MLLW (Mixed Low-Level Waste) and TRU (Transuranic Waste). Operations that will be conducted in the facility are numerous including storage, treatment, and preparation for disposal off site (packaging and transportation). No disposal is performed in Livermore National Laboratory for these wastes.

The facility will house much of the equipment transferred from other facilities in outdoor storage areas presently in use at Livermore. The DWTF has gone through a phased ORR (Operational Readiness Review) process mandated by DOE. This process includes the contractor getting ready to operate the facility, preparing a self-assessment report, then a readiness review by an independent contractor, with another review by the Department Of Energy. Essentially, all three assessments occur in series and all produce their share of corrective actions.

To claim readiness for this type of facility, one needs among other things, to obtain a RCRA (Resource Conservation and Recovery Act) permit to operate a "Treatment Storage and Disposal facility" from the authorized state. Also needed is a PAAA (Price Anderson Amendments Act) safety analysis from DOE to operate Category 2 and Category 3 nuclear facilities. The DWTF permit is based on an eleven-volume permit application, and a chemical health risk assessment that has faced public scrutiny the whole way. The Documented Safety Analysis (DSA) is based on approximately 100 generic accidents and a hybrid of DOE orders and regulations with little uniformity applied throughout the complex.

Other technical issues of little importance to formal reviewers included, a need to integrate ventilation, programmable logic control, specify and procure semi-custom equipment, transfer equipment from existing facilities to reduce down-time, or additional operational constraints phase start-up to meet schedule and resolve a punch list having over 700 items all after construction was concluded.

Politics helped. Local politicians participated in pushing the process through. Everyone involved in the project gave it a higher priority than before, but it did come at a price. Lawrence Livermore National Laboratory is managed through Livermore Site Operations part of the NNSA (National Nuclear Safety Administration). The waste operations at this site are directly funded through EM (Environmental Management) in DOE. EM is due to transfer its operations over to NNSA for Livermore soon. The Organization who operates DWTF for DOE has had to "sit on the fence" between organizations, and at the same time, providing information to the Government Accounting Office for a congressionally mandated audit of the progress in opening of the facility.

For those of us who used to focus on getting rid of waste for a living, it's been a pretty wild ride. The bottom line was that in certain circumstances, those that favor process can get their fix, but pressure still needs to be applied. Diligence and tenacity are still required, and personnel focused on results are needed to be able to open a facility with this sort of complexity.

INTRODUCTION

Experiences gained in the start-up of a regulated waste nuclear facility can be extremely beneficial, especially when gained by members of staff and technologists who will operate the facility. Opinions and case study of one such start-up are collected and presented here all from the operator's prospective.

LLNL (Lawrence Livermore National Laboratory) is a Department of Energy laboratory, presently run by the University of California, along with Las Alamos National Laboratory in New Mexico. The DWTF (Decontamination and Waste Treatment Facility) was a line item approved by congress in the early eighties. The DWTF was initially proposed and funded to replace facilities run in LLNL since the early sixties. The budget was re-scoped and re-approved through Congress several times to ultimately be built as a sixty-two million dollar facility to store, treat, and ship LLNL's generated mixed, low-level, TRU and hazardous waste.

A BRIEF HISTORY

The RCRA (Resource Conservation and Recovery Act) permit was submitted to the EPA in 1983. The DWTF was scoped and the line item was initiated in 1986. The original concept had a rotary kiln as its centerpiece. This kiln was to treat more waste and to replace a dual chamber pathological incinerator; used to destroy primary biological waste usually animal carcasses injected with tagged radioactive compounds (tritium, phosphors 32, sulfer-35, and carbon 14).

The current operating incinerator was also used to burn film and negatives (classified material) during the nineties; this became the incinerators biggest use. In California and "more progressive" states it became impossible to obtain RCRA permits for incinerators. During the mid to late 80's, both the operating pathological incinerator end came under public scrutiny. Ultimately, the operating incinerator failed an ambiguous trial burn and a brief non-technical report from a respected scientist employed by the University of California at LLNL. Basically, he said that emissions from incineration of radioisotopes are too big to be captured by Brownian motion and too small to be strained or captured by inertial impaction. This conceptual report essentially killed the rotary kiln and started closure of the existing incinerator. By the late 80's, the report was carried through the DOE complex as the reason not to build incinerators.

Without the rotary kiln, the project faced greater scrutiny, because the treatment method was essentially eliminated. There were several audits of the project. The project was initially designed by Bechtel and was put on hold from the middle of 1989 to the beginning of 1993; not justified by the loss of the incinerator, but more for the change needed to NEPA (National Environmental Policy Act) documentation because the centerpiece no longer existed in the project.

In the middle of 1993, with the help of justification from experienced operating personnel that included a formal justification to the Office of the Inspector General, several meetings in Washington DC occurred. The ultimate justification was that the facility was contained indoors and had single pass ventilation that kept contaminants inside. This was better than existing facilities where treatment activities were conducted outdoors. The justification was tricky because management never wanted for us to posture that we were out of regulatory compliance, or that we worked with regulated waste in an unsafe environment. In other words, it was extremely difficult to justify spending over 60 million dollars because we wanted to do things better, even though, what we are doing now is okay.

In 1994, the concept of having a national test bed for treatment where incinerator alternatives would be developed and treatability studies would be performed on LLNL, legacy waste was added to the project with the hope of obtaining research funds in areas of waste management. The MWMF (The Mixed Waste Management Facility), the test bed piggy back, lasted for about three years until the project leaders of MWMF (who were not experienced in the "waste business") realized that the largest waste streams they were targeting were already treated in existing facilities. There was discussion between senior waste management personnel and senior MWMF R&D personnel that led an agreement for waste management personnel, to stop treating the waste so that MWMF would have waste to test with. In fact, senior management made us move the entire backlog out of the treatment facility into the storage facility to prevent it from being treated. In less than one week, the MWMF portion of the project was curtailed. The DWTF once again had to survive on its own merit.

In 1996, LLNL and the new A&E contractor, Parsons, completed the design. DOE issued a NEPA FONSI (Finding Of No Significant Impact); LLNL completed a Preliminary Safety Analysis Report (PSAR) and started construction on the non-RCRA portion of the facility. The following year, LLNL completed the PSAR for the balance of the facility and initiated phased construction of the RCRA portions of the facility. In 1999, the RCRA permit was granted after a brief lawsuit in the same year. Construction was completed in the middle of 2001, shortly after the lawsuit was settled.

THE CONSTRUCTION PROJECT

The final A & E design was developed by Parsons Engineering. The DWTF picked up some MWMF real estate in its primary treatment facility because it was easier and less expensive to build the facility with MWMF added space. The contractor would have had to go back to costly redesign for the structure without if the space had to be removed. It turned out to be needed after observing operations presently. In comparison to existing facilities, the new treatment facility actually has less floor space if you compare it with the existing facility's blacktop.

After the construction company GSE won the bid, there was some re-planning to do because the Resource Conservation and Recovery Act permit was not approved. There were three portions of the facility. The first part was a low-level waste storage facility that did not need a RCRA permit. The second part was a portion of the RCRA permitted building that included office space and two laboratories that did not require permitting. The original phases of the project was re-phased to allow for construction earlier because of the RCRA permit delays. In fact, we still had to stretch construction out about one and a half years to wait for the RCRA permit from the State of California, Department of Toxic Substances Control (DTSC).

We faced more challenges than we expected during construction. We constantly had to keep the construction firm to the specifications, drawings and had to constantly compromise with the construction contractor to maintain schedule. We also realized that because of the shorter construction time allotted for the RCRA portion of the facility after permit approval, we had to accept deficiencies in minor construction details and had no real hard hammer to force compliance with specifications. The Waste Treatment Group in Radioactive and Hazardous Waste Management, (the building user or customer) had to do some of the construction them selves. In addition, during construction we needed to make sure equipment was constructed to meet the requirements of the Operations Plan (per the RCRA permit).

Late in the construction phase and after the contractor GSE concluded their work; there were a significant number of things to do. Over 700 punch list items needed to be completed. We literally discovered leaks daily for weeks after bringing on line building utilities and hydrostatically testing waste lines at normal operations pressures. Unacceptable foreign parts needed to be replaced or validated. All the bolts in our tank farm needed to be replaced because they were made of mild steel, not stainless steel as required by the specification (they were all rusting out even before operation). There were also things specified by the A&E contractor that were reviewed by LLNL engineers and management that happened to be way off base. For example, in general engineers tend to over specify equipment and building structure. This is due to the fact that engineering is not an exact science and safety factors need to be considered in the design. This can cause the opposite effect and reduce safety if not considered properly. Reagent tanks for Sulfuric acid and hydrogen peroxide were specified to hold 50 psi of pressure that was a mistake because both tanks were vented to atmosphere. In fact, hydrogen peroxide has to be vented to atmosphere because it decays slowly to water and oxygen. We have experience in "blowing" peroxide lines because of oxygen over-pressurization. These 400-gallon stainless steel tanks were installed in their secondary containment and were tested only to realize that they had to be cut out, sent back to the vendor and retrofitted because the man-way flanges leaked. The flanges were designed to hold 50 psi on the inside so these flanges seeped when tested at atmospheric pressure.

There were a few items that were not put into the facility because of cost, lack of need, or just because it was silly to do so. Unfortunately, some of these things were described in the operations plan, a requirement to get the RCRA permit. Two specific things were a density meters in each waste tank and float alarms in each trench in the secondary containment system.

The density meters are not needed because the wastewater specific gravity is around 1 and the tanks were designed to structurally hold a specific gravity of 2.1. The operations plan stated that we needed to verify that the tanks could hold the wastewater because the tanks were designed to hold waste with a specific gravity of 1.05. This criteria is not typical in an operations plan and our experience in operating a similar facility for over a decade has never shown wastewater weight to bee an issue. Nevertheless density meters were added to comply with the operations plan at a cost of about $45,000.00.

The floats with alarms were also installed to comply with the operation plan, although the trenches are clearly visible and are inspected daily. Again, over the past decade of operating the existing facility, leaks did not happen in such a sufficient quantity to trip a secondary containment alarm. The ones currently installed at DWTF really don't add value and will need to be maintained, as will the density meters. In fact, many of the "Bells and Whistles" will not provide benefit, only burden. Hopefully we will be able to phase many out of the operations plan with permit modifications if the public (our local activist group) does not see a perception of a reduction of safety (which is what we are facing with removal of other items).

ACHIEVEMENT OF READINESS OPERATIONS OF A FACILITY

There is a formal process through the Department of Energy rules called an ORR (Operational Readiness Review). In principle it is a process to allow DOE to have confidence that the contractor has made sure the stuff works (equipment and facility) and is competent to operate it.

What it really seems to be is another formal audit process not where contractor performance is evaluated but whether or not each individual program and each individual piece of paper is in order. The process requires a time intensive independent contractor review followed by a DOE review. The full ORR process was dictated for the DWTF (minimal graded approach, full blown ORR). This means the reviews cannot be done in parallel; they must be done in series. One thing was prevalent in this process and that was the independent contractor ORR staffing, looked at different things than the DOE ORR team. The facility operators got the benefit of being audited twice. As mentioned earlier, the process was supposed to be performance based to validate the operators are competent, the facility and equipment function properly. None of the findings or observations seemed to be based on performance and much of the discussion seemed to be based on current DNFSB and past reviews, in that they wanted increased formality of operations. Both ORR teams had opinions on how they wanted procedures and plans changed to meet their needs on how the paper should be written because, they felt the operators needed it.

It is our experience that most of the procedural changes to reflect what auditors think operators need and over time, the paperwork reflects the needs of reviewers much more than the needs of operators. An interesting irony showed up when one of the authors of this paper tried to explain this to an ORR team member (auditor or performance evaluator) and he whole-heartedly agreed and stated that is why you need to add this to your Facility Safety Plan (missing the point entirely). One technologist always likes to point out that auditors and DOE field office personnel need to see "don't run with scissors and don't stick a needle in your eye" statements in operating documents to make sure operators have what they need to operate safely. When looking at pure performance (watching people operate equipment) both ORR teams concluded that personnel are competent, can properly and effectively run the equipment and the facility. The DOE ORR team wanted additional machine guarding on the tank agitators, although they met OSHA requirements and an extra eyewash stations where no splash hazard truly exists.

One of the themes of disappointment of DOE and the contractor ORR team after successful performance was demonstrated, was the simple fact that, DOE wants more and "better" detail in the description of our operation and an easier set of paperwork to review to find information they wanted on facility design. Both the DOE and contractors ORR, wanted changes to our documentation or wanted additional documentation. The reason was not explicit. They just would have been more comfortable with it. We think that this theme of more and better detail, and the contractor not wanting to give it, stems from DOE's desire to become more knowledgeable about contractor operations and systems. Also it's their desire to change things or offer more opinions with the contractors desire to remain flexible in operations without ambiguous rules, detraction from mission, and the freedom to do things their own way. This is a consent battle and was prevalent throughout the operational Readiness Review but seemed to have little to do with demonstration of successful performance.

PREPARATION AND APPROVAL OF THE DOCUMENTAL SAFETY ANALYSIS

The Price Anderson Amendment Act 10CFR 830 requires the preparation of a Safety Analysis Report (or Documented Safety Analysis, DSA). This document when approved and combined with other key documents serves as the approval to operate a nuclear facility. This is called Authorization Basis (AB) to operate the facility. It seems that DOE and the watchdog of DOE (the Defense Nuclear Facility Safety Board) devotes a tremendous amount of focus to this area.

Performance measures in the University contract are set up to evaluate issues surrounding authorization basis.

Initial attempts at developing the DSA for the simplest building (TRU storage only) within the DWTF were submitted by LLNL and rejected by DOE. The reason for rejection was that the initial submittals were not 10CFR 835 compliant. After three rejections of the DSA submittal package, it was finally approved and a Safety Evaluation Report was written that included corrective action items for LLNL to perform.

The preparation of Building 695 (the treatment facility portion of the DWTF) DSA had to be accomplished in a relatively short time frame. A great amount of experience was gained in the development of the DSA for the storage building. For LLNL, the process of developing this DSA was still unique for several reasons. One fundamental difference was that the project leader was the facility operator, and not person with experience in development of authorization basis. Several other firsts that seems a little obscure were that written nuclear segmentation agreement had to be approved first before safety analysis report was written. A draft policy for AB review (a 30%, 60%, 90% pseudo-design review process) had to be employed. A new methodology for documenting hazard analysis had to be performed including the development of an aircraft crash scenario. Finally the DOE review team leader stated that this project was the lowest priority because the NNSA (National Nuclear Safety Administration) project work came first and the EM (Environmental Management) work had to take a back seat.

Eventually, the operating group had to draft the DSA because the AB personnel were too busy responding to DOE and DNFSB and these organizations desires resources to be spent on lab wide AB issues. It was prudent also to have the operating groups do it because they would be constantly burdened by AB staff for technical details regarding DWTF equipment and operations. The operating groups knew the facility description and were involved with the design. Since they have operating experience with the older facility they were the most familiar with any plausible accidents.

Many things changed during the process mostly because of limited resources. Even though there were three DSA writers and thirteen DOE reviewers all had other work to do and because the B695 DSA development was not, the DOE lead reviewer priority the segmentation justification was not approved until the DSA was approved. The draft review process (the pseudo-design review) process was supposed to expedite review and allow for decisions from the review team easily or at least during the preliminary writing process. Unfortunately as with the segmentation justification, DOE made no commitments or decisions because of the lack of resources or perhaps the lack of authority by the DOE review team. The contractor had to develop the SAR at risk. This again is similar to building part of the non-RCRA facility not certain that we would get the permit for the rest.

The aircraft crash accident scenario development took the most resources because of the differences of professional opinion. Additionally, the DOE review team appeared almost pathologically unable to consistently apply the DOE order applying to aircraft accidents.

Discussions were all over the map, from considering touch and goes outside the crash zone, the frequency of flights across the facility, to how much fuel and how big the aircraft would be. Most of the time spent on these discussions appeared to be purely academic and fruitless because the mitigation control is emergency response.

The "new" way to document hazard analysis allowed less conservatism but came into the process a little late caused us to re-do what we did, but the AB staff gave the team excellent support to get this done. This helped set precedent for the institution to provide for less conservatism and more uniformity in hazard analysis preparation.

Because of political pressure, which will be discussed later concerning start-up of DWTF, a myriad of other issues some related to AB, but primarily through the fact that EM-HQ perceived that NNSA is not making EM issues priority (LLNL is an NNSA site not an EM site). DOE HQ (EM) pulled approval authority from the DOE field office. Despite the obstacles HQ was supportive and was on the same page as the contractor. The SAR was approved on time and at a cost of about 30% of what was anticipated. One unfortunate part of the process was that over 300 comments needed resolution and 13 signatures were needed on the DOE Safety Evaluation Report for approval.

FACILITY DESCRIPTION

The LLN Facility is a new state-of-the-art, integrated facility for storing and processing hazardous, radioactive and mixed wastes. It became operational in September of 2003. Figure 1 shows an aerial photo of the facility, looking north. The bigger white building center-left is the primary treatment facility (Building 695).

Fig. 1 An aerial photo of the decontamination and waste treatment facility (DWTF)

The DWTF consists of the following buildings:

Building 693 - Chemical waste storage
Building 694 - Operational Support
Building 695 - Liquid waste processing (primary treatment)
Building 696 - Solid waste processing and storage
Building 697 - Chemical Exchange Warehouse (CHEW)

Building 693 was actually built much earlier (1987) than the rest of the DWTF through other contracts. This was the first building in use to store waste in the DWTF and is a metal prefabricated building consisting of 4 storage cells with secondary containment. Building (B694) housing operators, first-line management, and other operational support personnel and is basically an office building. The Liquid Waste Processing Building (B695) is 17,000 square feet with a tank farm that has “closed” tops and is routed to the process off-gas (POG) system to eliminate acid gases and organic vapors. It has three glove boxes, two fume hoods, and a high ventilation room to process reactive and highly toxic materials. The building is equipped with a process development lab for treatability studies, process verification, and small-scale treatment. The Solid Waste Processing Building (B696) is 24,000 square feet and equipped with two 5-ton bridge cranes, drum crushers, a laminar flow hood, and a glove box that can be used to open, repackage, segregate, and ready for disposal of whole 55-gallon drums of waste. The chemical exchange warehouse (B697) stores product material for reuse and has been in operation for some time. The other buildings will be used for high-curie waste, classified waste, and other wastes managed by HWM personnel. Figure 2 is a general layout schematic of the DWTF complex of buildings and structures. Figure 3 is a general layout of Building 695’s interior showing a general layout of equipment, tank farm and rooms.

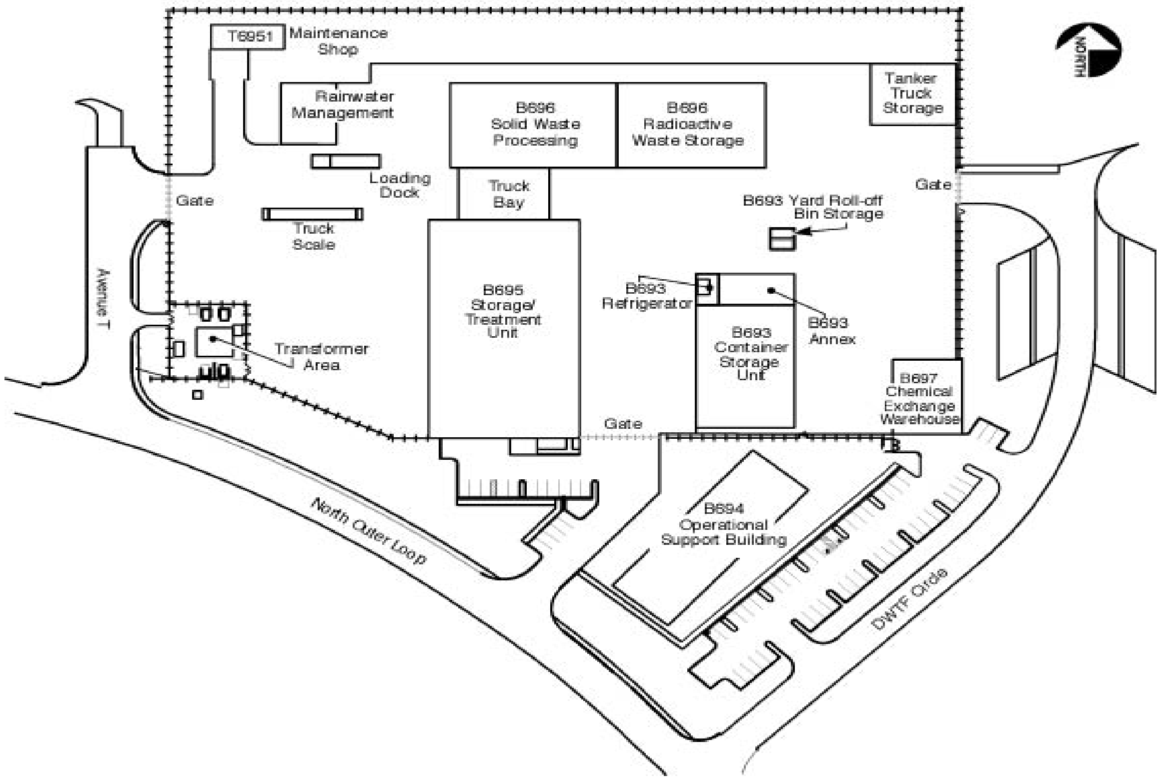

Fig. 2 The DWTF complex of buildings

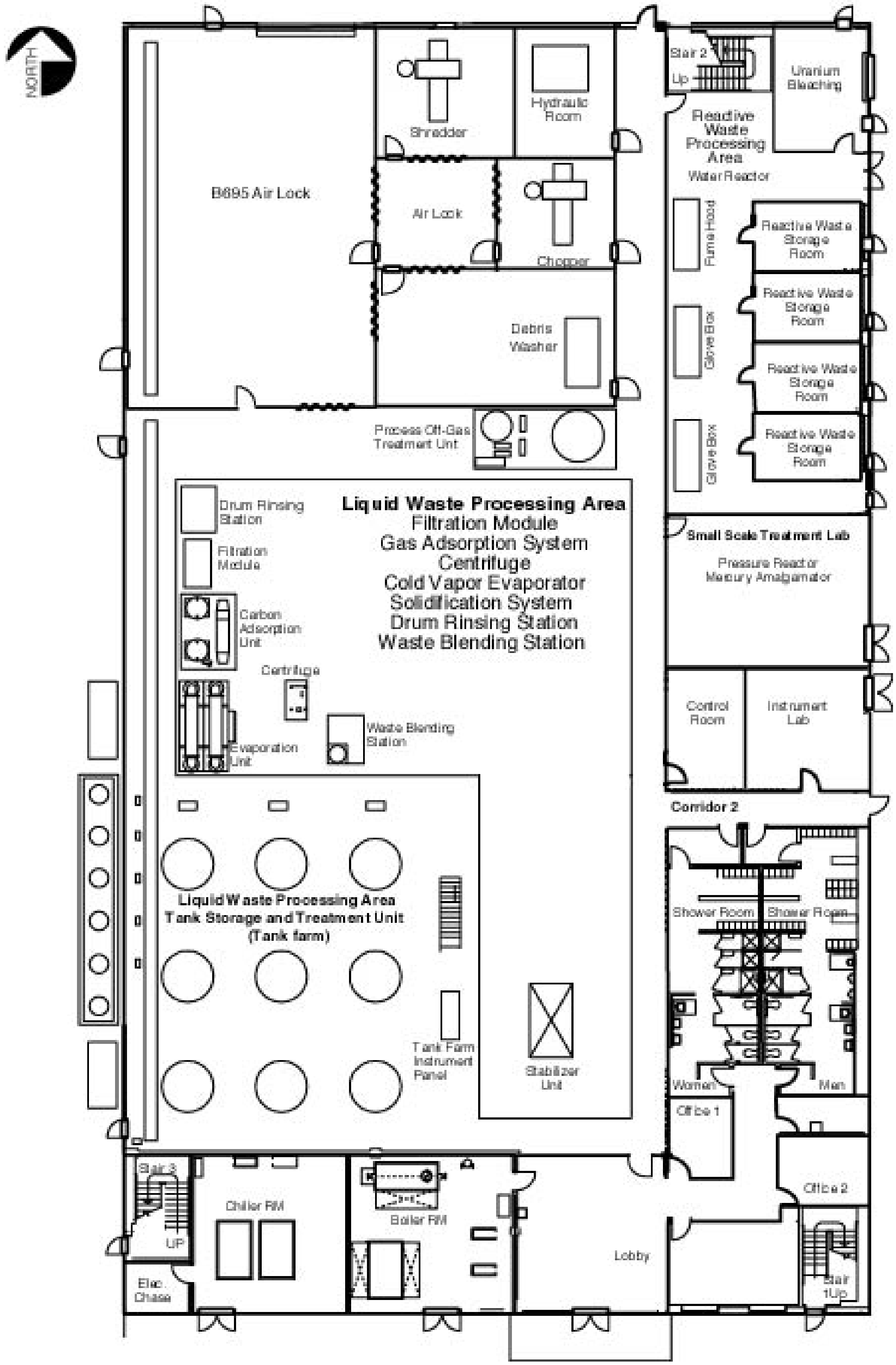

Fig. 3 Building 695 general arrangement of rooms, process equipment and tank farm

KEY FACILITY FEATURES

The key features of this facility are those that are integrated and distributive. The two that deserve mention are the ventilation system and the programmable logic control system. The process equipment in Building 695 is also key to managing the waste in the DWTF complex.

FACILITY AND EQUIPMENT CONTROL

The Control system of the Liquid Waste Processing (LWP) area of the DWTF is a Hybrid system consisting of a distributed control system (DCS) and a dedicated PLC control system. The system is controlled by two Programmable Logic Controllers (PLCs) linked together on a high-speed network. These two PLCs have, as their main function, control of the Tank Farm operation (e.g., valves, pumps, stirrer motors), additionally, all the sensor inputs and control outputs to and from the building. The "distributed" part consists of some interfacing communications with other independently controlled waste treatment equipment throughout the building. Data is "distributed" over Allen-Bradley's proprietary Data Highway Plus (DH+) Network. Another feature of this state-of-the-art control system is the alarm panels. Alarm signals from mainly tank farm other treatment equipment such as the evaporators, a portable blending unit, a carbon adsorption unit and the process off-gas system are transmitted to these two PLC's, which in turn control the lights on the two alarm panels. One panel is in the Supervisory Station and the other in the middle of the processing area.

At various places around the building there are "sockets" that allow an operator or supervisor to plug in devices into the Allen-Bradley (AB) network. One of the devices that can be plugged in is the Allen-Bradley Panel View Operator Terminal. Each Panel View contains all the screens for most of the equipment in the LWP area. This allows an operator to plug in a terminal almost anywhere and monitor and in some cases, where appropriate, control. Some of the equipment is also on skids so that it can be moved around the LWP area, as needed, for particular waste treatment operations or as space requirements permit. The combination of these two features allows for great flexibility of treatment scenarios. It also provides room for any future treatment needs as they may arise.

In the LWP building we have an Operator Interface Terminal, a Panel View, on a specially made wheeled cart. The cart can be moved to one of the many locations throughout the facility where the network socket is located. This provides great flexibility in where particular treatment equipment is located.

Another exciting feature of this control system is the ability to view RSViewTM screens over the Internet using a web browser. The supervisory system PC has been set up with an Internet connection and can act as a Webserver using Allen-Bradley's WebServerTM software. An operator or supervisor can, with a proper password of course, see snapshots of the monitor screens in real time thus gaining almost instantaneous access to information about the state of many of the treatment units in the facility.

VENTILATION

A primary issue in the solicitation of funds from the congress for a new waste treatment facility at LLNL was that it provides greater safety for workers and the environment than existing LLNL facilities. This requirement led to the design of a fully enclosed and ventilated facility that addresses these issues by establishing a controlled environment in which potentially dispersible radioactive materials can be managed.

The DWTF complex is equipped with a main ventilation system comprised of two primary supply air units and three banks of combination fan/HEPA filter exhaust units. These provide 112,500 cubic feet minute (cfm) of building exhaust for the two buildings in which work with potentially dispersible radioactive material occurs (The DWTF complex is comprised of five buildings, of these, two buildings B695 and B696 are served by the ventilation system). Under normal conditions approximately 70,000 cfm of air is exhausted, resulting in 4 to 6 air changes per hour and satisfying an LLNL Health and Safety requirement for facilities handling toxic materials. The system is designed to maintain a slight negative differential pressure between the outside relative to the building interior structure as well as, adjacent ventilation zones in the building. Fresh air is taken into the facility through the supply side of the ventilation system and directed into increasingly deeper air controlled zones within the building prior to entering the facility exhaust system.

Facility utility systems including the ventilation system are controlled by a computer based facility management system (FMS); the Johnson Controls METASYS system controls systems throughout the facility and looks at two main parameters to maintain control over facility ventilation. In order to calculate the exhaust fan speed for the facility a gross exhaust demand is calculated by summing the individual exhaust valve demand signals flow (in cfm) serving specific zones in the facility and comparing this to the signal provided by the supply valves flow (in cfm) and maintaining a specific air infiltration offset volume between these values. Maintaining the offset results in the slight pressure differential between zones

Phoenix Controls Accel II variable air valves are used on both the supply and exhaust sides of the system. These valves provide flow control in two ways; During periods of relative stability within rooms and control zones, the valve itself passively adjusts to slight pressure and airflow variations by a spring damped conical plug that slides on a shaft mounted along the centerline of the valves venturi body. This feature allows them to behave relatively independent of pressure and maintain constant flow volumes as long as the differential pressure across the valve (inlet relative to discharge) is maintained within 0.6 to 3.0 inches water gage. In the event of large variations in temperature or airflow these valves compensate by employing pneumatic pressure to adjust the position of the center shaft along the centerline of the valve.

These flow components allow comprehensive control of the airflow within the facility and provide LLNL workers and the public a greater degree of safety than was previously possible in existing treatment facilities.

PROCESS EQUIPMENT

Liquid waste treatment is performed in a standard industrial fashion. We use a tank farm precipitate and flocculate then filter. Often support treatment equipment is necessary to meet sewer limits and to get water from waste. We use a centrifuge to remove heavy sludge and light liquid and two evaporators (actually stills) to evaporate water off of the radioactive salts. After filtration and evaporation water is sent to sanitary sewer. Concentrate from the evaporator and residue from filtration is then stabilized using a modified double planetary change-can mixer to meet regulatory leaching criteria such as the federal TCLP (Toxicity Concentration Leaching Procedure). Solid debris is shredded using one of two hydraulically operated low-speed high-shear shredders and then washed using our debris-rule treatment unit. Once washed, this waste meets land disposal criteria. The wash solutions are treated as discussed above. Other small-scale treatment is allowed in our laboratory and reactive waste processing areas were pressure reactors, fume hoods, inert atmosphere glove-boxes and other equipment may be used to process waste.

CONCLUDING REMARKS

The DWTF is a wonderful facility we are proud to operate. Getting it off the ground took shear perseverance. For some of us who are long time waste managers who focus on getting rid of waste for a living, it's been a pretty wild ride. About 18 years since inception we have been charging up hill. Without political pressure, great tenacity, senior management (contractor and DOE) support and long sustained hours it is literally impossible to put in a facility such as this in (especially California). Maybe for those of us who drink, it's a little easier.