

WASTE RECEIVING AND PROCESSING (WRAP) FACILITY – PART OF THE SOLUTION

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ABSTRACT

The Waste Receiving and Processing (WRAP) Facility is a state-of-the-art facility designed to consolidate the operations necessary to inspect and process waste to facilitate verification of contents for certification to established waste acceptance criteria. The WRAP facility will inspect, characterize, treat, and certify transuranic (TRU), low-level and mixed waste at the Hanford Site in Washington state. The \$55 million facility is operated by Waste Management Federal Services of Hanford, Inc. for Fluor Daniel Hanford under the Project Hanford Management Contract. WRAP has recently (September 1998) completed all applicable U.S. Department of Energy (DOE) requirements for startup and received authorization to commence operations under its approved authorization basis documentation. This paper describes the WRAP Facility, its capabilities and planned operations, and lessons learned in accomplishing the objectives of permitting and authorizing the startup of a hazard category 2 nuclear facility under DOE Orders 5480.23, Nuclear Safety Analysis Reports, and 425.1, Startup and Restart of Nuclear Facilities.

The WRAP Facility is relatively unique in the DOE complex. Relying heavily on ALARA principles, WRAP was conceived, designed and built to inspect, examine and assay waste containers, provide the capability to open containers for inspection within a containment boundary, sample contents, remove non-compliant or suspect objects, perform limited treatment, and repackaging wastes in accordance with established acceptance requirements. State-of-the-art nondestructive examination and assay (NDE/NDA) instrumentation is provided to aid in verifying the contents of filled waste containers. Suspect or noncompliant items identified through NDE can be removed in the process area glove boxes that provide containment for control of radioactive and hazardous constituents. To minimize worker contact with the waste and comply with ALARA objectives, opening of waste containers is only accomplished in glove boxes designed to facilitate remote handling using manipulators and automated handling devices.

Waste streams include newly generated waste, previously buried TRU waste retrieved from long-term storage, suspect TRU waste that may not meet the current TRU definition (exceeding 100 nCi/g of TRU alpha activity), and low-level waste destined for disposal or treatment that may require verification of contents. In addition, mixed waste may be characterized through WRAP processing, and Land Disposal Restriction (LDR) constituents evaluated. With increasing emphasis on certification of contents to ensure

full disclosure, WRAP provides a capable and controlled setting designed for providing that vital link between waste generation and disposition that has been heretofore missing from Hanford facilities. The WRAP Facility will become a key "part of the solution" for cleanup of the Hanford Site by providing a path for shipment of TRU waste off site and disposal of LLW on site.

This paper is of interest to people involved in most aspects of radioactive waste management as a success story in accomplishing a complex mission in a manner that has been fully evaluated and determined to be safe and acceptable. This paper provides details of interest on the facility design, reviews, operations and approvals. Lessons learned in the process are presented for the benefit of others who may be interested in constructing or approving similar facilities.

PURPOSE AND SCOPE

The WRAP facility is a waste management facility located in the 200 West Area of the U.S. Department of Energy's (DOE) Hanford Site (Figures 1, 2, and 3). The \$55 million facility is operated by Waste Management Federal Services of Hanford, Inc. for Fluor Daniel Hanford under the Project Hanford Management Contract. WRAP has recently (September 1998) completed all applicable U.S. Department of Energy (DOE) requirements for startup and received authorization to commence operations. This paper provides a summary description of WRAP and its design and authorization basis documentation. The WRAP facility Module 1 (WRAP 1) was originally planned as the first of a larger complex of waste processing facilities. The other facilities are no longer planned. The acronym WRAP is synonymous with WRAP 1 or WRAP Module 1 found in earlier documents.

The WRAP Facility will provide receipt, confirmation, repackaging, certification, treatment, and/or storage of waste from onsite activities and from offsite generators. WRAP is located within the 200 West Area as shown in Figure 2. The 200 West Area, 213 meters above mean sea level, is 97 meters above the level of the Columbia River, which at its nearest point is approximately 9.6 kilometers from WRAP. State Highway 240, which runs through the Hanford Site, passes approximately 4 kilometers from WRAP. The distance from WRAP to the Hanford Site boundary ranges from a minimum of 11.7 kilometers to a maximum of 33.0 kilometers. The public can travel on the Columbia River and State Highway 240, both of which pass within the Hanford Site boundary.

The Hanford Site was selected in 1943 by the U.S. Army Corps of Engineers for the production of nuclear weapons material. Current activities on the Hanford Site focus on environmental restoration, waste management, and technology research. As DOE solid waste disposal activities have evolved over the past five decades, an increasing recognition of the need to characterize waste being disposed has developed. This need for more detailed information on waste form, content and chemical composition has been driven in part by increasingly restrictive disposal requirements, as exemplified by current RCRA laws prohibiting disposal of many hazardous materials prior to treatment. In the case of DOE transuranic (TRU) waste, limited, and costly, disposal capacity also drives a need to ensure that only qualifying waste is disposed as TRU. These increasingly

demanding characterization needs require relatively sophisticated waste examination processes to ensure that candidate waste destined for disposal meets disposal acceptance requirements while ensuring that As Low As Reasonably Achievable (ALARA) objectives are met by protecting workers from exposure to any hazardous constituents in the waste.

Beginning in 1970, TRU waste has been placed in underground retrievable storage at Hanford. Since this emplacement began, the definition of TRU waste has changed from material contaminated with TRU nuclides at levels greater than 10 nCi/g of TRU alpha activity with half-lives greater than 5 years, to 100nCi/g with half-lives greater than 20 years. Therefore, some waste in retrievable storage will not be TRU by today's standards and will be disposed as LLW. However, differentiating between TRU and LLW requires sophisticated measurement (assay) methods to distinguish these relatively low levels of alpha activity in packaged waste. One of the missions of WRAP is to safely provide the means to accurately assay waste to determine whether it is TRU. Therefore, WRAP is considered a key component in the infrastructure necessary to safely and compliantly dispose of contaminated waste.

FACILITY DESCRIPTION

The WRAP Complex consists of three structures housing process and process support systems and various support and utility systems. The main WRAP structure (2336W) consists of the following areas: waste shipping and receiving; NDE/NDA; waste processing; control and computer; electrical and mechanical equipment, including heating, ventilation, and air conditioning (HVAC); and personnel support offices. Two adjacent buildings house maintenance (2620W) and administrative support (2740W) functions. Figure 3 shows the WRAP site plan.

The WRAP facility is a pre-engineered metal building with a ground floor and a partial second floor. The structure is of beam and column type construction typically supplied by pre-engineered metal building manufacturers. The building houses all waste processing and process support systems and various services and utility systems. The facility design provides access control for areas containing hazardous materials and operations as well as segregation of administrative and other support personnel from the process areas. The WRAP structure contains about 4,766 square meters of total floor space.

The personnel support area located off the main traffic path to the operational areas consists of offices, a conference room, dining area, storage rooms and change rooms. Change rooms are sized for up to 60 operations personnel per shift.

WRAP receives containers (drums or boxes) of contact-handled waste (surface radiation levels <200 millirem per hour) from Hanford Site generators, onsite storage at the Central Waste Complex (CWC), waste retrieval operations, and offsite generators. WRAP is designed to receive and process up to 6,825 containers of waste annually, consisting of 2,625 containers of retrieved waste and 4,200 containers of waste from cleanup activities and waste management operations. The waste received at WRAP is expected to consist

of approximately equal numbers of TRU and low-level waste (LLW) drums, including some that contain mixed waste. In addition to the drummed waste that will be processed, WRAP will perform nondestructive examination (NDE) and nondestructive assay (NDA) on standard waste boxes.

The WRAP facility contains three main operating areas where all waste handling/processing operations are performed:

- 1) The shipping/receiving area where closed waste containers are stored awaiting processing. The shipping area also contains a TRU Package Transporter (TRUPACT) loadout bay for transfer of TRU waste to the Waste Isolation Pilot Plant in Carlsbad, New Mexico.
- 2) The NDE/NDA areas where closed containers undergo inspection for prohibited items and to determine their radionuclide inventory. The NDE/NDA area contains 2 drum x-ray and 4 drum assay units (2 gamma energy assay and 2 imaging passive/active neutron assay units), and 1 box x-ray and box assay unit (to our knowledge the only box waste assay system in the Complex).
- 3) The process area containing the gloveboxes where waste drums are opened individually for inspection, sorting, and/or treatment. The process area contains 4 gloveboxes: a TRU glovebox, a low-level waste glovebox, which includes a supercompactor, and 2 restricted waste management gloveboxes (1 for TRU and 1 for low-level waste) that allow for sampling and treatment of noncompliant waste items.

The shipping and receiving area occupies the southeast corner of the building and is entered from the main traffic corridor. The finished floor elevation of the area is above the adjacent exterior grade to accommodate two dock-height waste unloading stations and a depressed drive-through bay for TRUPACT container loading. Vehicles back up to the two dock-height waste unloading stations to load and unload waste containers. The depressed drive-through bay is used for loading TRUPACT containers for offsite shipment of TRU waste to the WIPP. An automated stacker/retrieval system (AS/RS) for container storage is located in the shipping and receiving area. Additional container storage is provided in the TRUPACT loading area. Storage space for boxes also is provided in the shipping and receiving area.

In the shipping and receiving area, personnel use container-handling equipment (e.g. forklifts, overhead cranes) to unload and move waste drums and boxes. An automated guided vehicle (AGV) is generally used to transport drums between the shipping and receiving area and the NDE/NDA area. Processed and certified TRU waste containers can be loaded into TRUPACT shipping containers using an overhead crane. Processed LLW containers are loaded onto trucks at the loading dock for storage or disposal on the Hanford Site.

The NDE/NDA area is located adjacent to the shipping and receiving area in the southwest corner of the building and typically is entered through two roll-up doors connecting the two areas. In addition to the NDE and NDA stations, the area is equipped for the storage of up to 12 containers on a storage carousel. Airlocks are provided to

facilitate the transfer of containers by conveyors into the controlled process area and to provide emergency personnel egress from the NDE/NDA and process areas. Waste drums and boxes are examined and assayed in the NDE/NDA area. Waste boxes are transported by forklift and drums are transported by the AGV or manually from the shipping and receiving area to the NDE/NDA equipment.

When it is desired to open drums to verify contents or remove restricted items identified in the NDE process, waste drums are transferred through an airlock to the process enclosure lines (glove boxes) in the process area located adjacent to the NDE/NDA area in the northwest portion of the building. TRU drum processing is accomplished in enclosure sections where drums are opened and emptied, empty drums are compacted, waste is sorted, noncompliant items are removed, waste is repackaged, and the repackaged drums are loaded out. The TRU line also has the capability to assay and X-ray small items. The LLW enclosure line operations are similar to those in the TRU enclosure line except drum supercompaction can be performed after repackaging. There are two Restricted Waste Management (RWM) enclosure lines, one for TRU-containing restricted waste and one for LLW. Noncompliant items removed from drums in one of the process enclosure are sent to the appropriate RWM enclosure line. The TRU and LLW RWM enclosure lines allow for sampling, treatment, and repackaging, as necessary. The processed waste drums from all four enclosure lines are transported back through the airlock to the NDE/NDA area and to shipping and receiving for shipment to a storage or disposal facility.

The process area serves as secondary containment when waste containers are opened. Personnel access to the area is restricted to step-off pads and process airlocks. Waste containers routinely enter and leave the process area through the airlock located in the NDE/NDA area. An additional nonpersonnel airlock is provided for the transfer of sample containers between the process area and the sample management office. An exterior view of a process enclosure and a drum inside an enclosure are shown in Figures 4 and 5.

The process exhaust HVAC area is located adjacent to the process area and contains the exhaust fans and HEPA filtration equipment associated with the process area. Two emergency personnel exits through airlocks are provided directly to the outside. The process exhaust HVAC area contains two Zone I and two Zone II ventilation exhaust systems. These exhaust systems provide the ventilation confinement zones for the process enclosures and the waste handling areas, ensuring any airborne contamination flows from potentially less contaminated to more contaminated areas. Each exhaust system consists of plenums, two stages of HEPA filtration, exhaust fans and associated valves, instruments, and controls.

An elevated exhaust stack is provided to disperse filtered exhaust air into the atmosphere and to provide for continuous sampling and monitoring of emissions. The WRAP stack is located adjacent to the west wall of the building, toward the north side. The stack location and height take into consideration the prevailing winds and wind effects, including building effects on the airflow. The stack is designed to prevent intake of the

exhaust by WRAP and adjacent facilities. The stack also has ample clearance from other structures that could restrict airflow or cause recirculation of exhausted air. The stack sumps are designed so that routine draining, maintenance, and other operations can be performed without entering the stack.

The control room and computer area, located on the upper level, contains control consoles for the NDE/NDA equipment, communication equipment for dispatcher functions, alarm annunciator panel, printers, central processing units, and miscellaneous supporting elements. This location permits direct observation of the shipping and receiving, NDE/NDA, and process areas through windows overlooking the waste handling areas.

FEED STREAM

Approximately 38 percent of the total WRAP feed stream is expected to consist of containers of suspect TRU waste from 55 onsite and offsite generators that were placed in retrievable storage between 1970 and 1990. The following paragraphs describe the physical, radiological, and hazardous constituents of this feed stream. The characterization data are derived from solid waste storage/burial records prepared at the time of storage, process histories, and interviews with personnel from the generating facilities. This general waste descriptions is also applicable to currently generated waste, although current acceptance criteria require more specific details for each container.

Before the retrieved waste is sent to WRAP, historical characterization data in the solid waste storage/disposal records are augmented to the extent possible with field screening characterization data performed at the retrieval site. Table 1 lists the recorded physical contents of typical stored TRU waste containers. Significant numbers of containers are expected to contain waste forms that present industrial-type hazards, such as obscured sharp objects and objects of needle point sharpness.

Suspect TRU waste was first retrievably stored on the Hanford Site in May 1970 (IAD-0511). Table 2 provides a TRU gram distribution for typical 208-liter drums retrievably stored on the Hanford Site (WHC-SD-WM-TI-517). Mixed fission products (MFP) are the most abundant non-TRU radioactive constituents listed in storage records for this period (WHC-EP-0225). The relative abundance of MFP associated with these typical 208-liter drums is shown in Table 3.

Solid Waste Stream Hazardous and Dangerous Components (WHC-SD-WM-RPT-056) provides a candidate list of all known hazardous constituents that may be present in the retrieved suspect TRU waste. The list was generated by performing a query of the Solid Waste Information Tracking System database (information concerning nonradiological chemical constituents was not required on these records until 1986). Nearly 400 hazardous chemicals were identified that are known to exist in containers generated through 1991. From this list of hazardous materials, a shorter list of bounding hazardous constituents (Table 4) was compiled based on the estimated relative hazards, abundance and persistence of the hazards.

EQUIPMENT

The following NDE/NDA technologies are provided for examining and assaying waste drums (208- and 322-liters) weighing up to 450 kilograms, standard waste boxes weighing up to 1,800 kilograms, and waste boxes measuring up to 2.4 meters by 1.5 meters by 1.5 meters and weighing up to 3,200 kilograms:

Radiography, consisting of X-ray fluoroscopy with image intensification, linear diode array analysis, and video recording to identify noncompliant waste in sealed containers and to certify the waste containers in accordance with storage and shipping criteria

GEA interrogation of containers, to detect and quantify radioactive isotopes; PAN of containers to quantify fissile contents; and equipment to interface these measurement systems with the WRAP Data Management System (DMS).

Real-time radiography is performed on incoming waste containers that have not previously undergone radiography and on a percentage of the outgoing processed waste containers. To ensure a complete scan, the drum units are capable of rotating, raising, and lowering the drum. The box unit has a two-dimensional movable X-ray head. The X-ray generator system is under direct control of the NDE operators in the central control area. The operator will increase or decrease the power to evaluate different waste items within the waste containers. The NDE operators will enter information on dense or noncompliant waste items into the DMS.

The PAN counting and GEA could be performed on incoming waste containers and, as required, on outgoing processed waste containers. These measurement techniques do not alter the physical and chemical properties of the waste and do not present a risk in terms of initiating credible accident scenarios. Separate stations are provided for waste drums and boxes.

Because of radiation normally emitted from the NDE/NDA equipment, shielding is provided between the units to increase the individual assay unit accuracy.

WIPP certification requirements include detailed calibration and quality assurance checks to ensure the accuracy of assay results. WRAP is in the process of obtaining WIPP certification for its assay systems. The possibility of NDE/NDA equipment failure, resulting in false assay/examination results, is minimized by rigorous verification and calibration requirements. Containers with known waste matrices and radionuclide contents are used as standards for periodic verification of all NDE/NDA equipment.

The following equipment is used in support of the process enclosure lines to enable remote or safe handling of the waste.

- Remote manipulator arms: In both opening and sorting areas and in both RWM enclosures, remote manipulator arms provide the primary means of handling waste. These arms are microprocessor-controlled with multiple axis

servo-hydraulic systems specifically designed for manipulative tasks in hostile environments or inaccessible areas.

- Drum delidding/reloading station: The drum clamp band is removed manually or with a cutting/sawing tool. The lid removal fixture is lowered by a pneumatic actuator to capture the lid. After drum processing, the lid is fixed in place using C clips for compaction.
- Drum lift tables: Drum lift tables are present at each process enclosure. The drum lift table is a hydraulic scissor lift with a powered conveyor deck.
- Automated Guidance Vehicle (AGV): An AGV or manual drum handling equipment is used to transport waste drums between different locations in the waste processing area.
- Drum transfer conveyors: Chain-driven roller conveyors are used in the waste processing area at the airlocks to transfer drums off and onto the AGV going to and from the NDE/NDA area.
- Waste drum storage carousel: An accumulating roller conveyor/drum storage carousel in the process area is used for the storage of up to 24 waste drums, each weighing up to 453.6 kilograms. The carousel system includes two 10-meter sections, one 1.5-meter section, and chain-operated pop-up angle transfer sections.
- Bagless Transfer Systems: Four bagless transfer systems are used in WRAP, namely: the BNFL "one trip" drum; the 208 liter Drath and Schrader system (Drath and Schrader is a trademark of Babcock Rohrleitungsbau GMBH); the entry/exit system; and the BNFL small purged port system. All systems operate on the "standard" double-lid principle.
 - The BNFL "one trip" system uses a "paint can" type lid within the standard 208 liter drum lid. This inner lid is 54.6 cm in diameter and is placed on a soft, closed-cell neoprene seal on top of the drum lid (when the drum has been filled and is ready for closure).
 - The 208 liter Drath and Schrader drum port is a proprietary piece of equipment and is used for transfers of materials between the waste process enclosures and the RWM gloveboxes. The system is based on the "standard" double lid principle, and relies on several seals between the drum and the glovebox and between the port door and the drum lid.
 - The entry/exit system is used for LLW only, and is used in two sizes. A 322 liter drum size is used in the LLW process line for load-out and a 208 liter drum size unit is used in the LLW RWM glovebox for load-out. In both cases, the drum is held in an opening in the glovebox, the drum lid is pulled

onto a seal on the underside of the port door and both the port door and drum lid are swung into the glovebox. On completion of filling of the drum, the lid is replaced, and an operator manually attaches a clamp band.

- The BNFL purged port system is used as a 16.5-cm diameter unit, and although the double lid principle is used, it relies on a purged air gap around the port door and container lid, rather than on seals, and in this way the "ring of contamination" is avoided.

STARTUP OF OPERATIONS

DOE approval of a comprehensive Final Safety Analysis Report (FSAR) written to comply with the requirements of DOE Order 5480.23 was a prerequisite to authorizing operations. WRAP originally was classified as a low hazard facility (WHC-SD-WO26-PSE-001) in accordance with DOE Order 5481.1B. The performance goals for low hazard facilities, according to UCRL-15910, are to maintain the capacity to function and to ensure occupant safety. To achieve these performance goals, low hazard facilities must be designed to survive natural phenomena hazards such as wind, floods, seismic, snow loads, etc. With the approval and application of DOE Order 5480.23, DOE-STD-3009-94, and DOE-STD-1027-92, WRAP was re-evaluated and categorized as a Hazard Category 2 nuclear facility. Based on the hazard and accident analyses, WRAP requires no safety-class structures, systems, and components. Approval of the FSAR was documented in a Safety Evaluation Report (SER) providing the bases for DOE approval of operations.

DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

Technical Safety Requirements (TSRs) define acceptable conditions, safe boundaries, and management or administrative controls required to ensure safe operation of a nuclear facility and reduce the potential risk to the public and workers from uncontrolled releases of radioactive materials or from radiation exposure because of inadvertent criticality (DOE Orders 5480.22 and 5480.23). The WRAP Final Safety Analysis Report provides the basis for the TSRs governing WRAP operations. TSRs are graduated in terms of the safety significance of the items they control.

Based on the accident analyses performed for WRAP, coupled with the comprehensive administrative controls ensuring validity of the accident analyses, there are no postulated accidents at WRAP that would result in unacceptable unmitigated consequences to members of the public or nearby workers. Therefore, there are no Safety Limits, Limiting Control Settings, Limiting Conditions for Operation, nor associated Surveillance Requirements identified for WRAP.

Administrative Controls (ACs) are the provisions relating to organization and management, procedures, record keeping, reviews, and audits necessary to ensure safe operations. TSR ACs at WRAP include the following:

- Handling and reporting of TSR deviations or violations
- Staffing levels and positions required for safe operation of the facility
- Physical and administrative controls for criticality safety and inventory control
- Other safety programs.

The operations contractor is responsible for operating WRAP within the approved safety basis and for maintaining the current DOE-approved FSAR and TSR documents as controlled documents.

The principle of defense in depth has been applied to WRAP design and operation planning through the use of strong, tight, substantial containers; dedicated process lines; process enclosures; and ventilation zones, airlocks, and curbs. Hazardous waste materials are distributed throughout WRAP in drums and boxes, with the largest concentration in the shipping and receiving area. Operating procedures, requirements, and limits specify allowable hazardous material types and quantities, internal packaging, material form, and container characteristics.

A program for documentation of the operational mode status of WRAP is established, implemented, and maintained to ensure the facility status is documented and remains current. TSRs, including ACs, are applicable unless otherwise noted during all modes. Additionally, ACs not covered as TSRs are compiled in a compliance matrix and tracked to ensure proper implementation.

Acceptance of nonradiological hazardous waste materials at WRAP is controlled to ensure that accidental exposures to facility workers, collocated workers, and the public will not exceed established guidelines. A program has also been implemented to control building combustibles so as to remain within the inventory analyzed in the FSAR.

The WRAP FSAR contains a summary of the characteristics of the Hanford Site that have been researched and documented since the early 1940s (WHC-SD-W112-RPT-001) to support safety analyses. The centralized location of the WRAP Facility near the other solid waste facilities in the 200 West Area was chosen based on the results of a site selection process described in *The Hanford Central Waste Complex Site Evaluation Report* (WHC-SD-W026-SE-001), which provides for optimum intrasite waste transfers.

After the FSAR was approved and implemented at WRAP, several reviews of operational readiness were conducted prior to authorizing full operations. These reviews included a management self-assessment by the operating contractor, a formal contractor Operational Readiness Review, and a final DOE Operational Readiness Review. Through these extensive and comprehensive reviews, it was determined that WRAP operations could be conducted safely within the constraints and limitations imposed in the authorization basis documents.

LESSONS LEARNED

Several items became obvious as the safety and operational reviews were conducted to verify the acceptability and readiness of WRAP to operate. These include some items that are not readily controlled, such as ensuring that the “rules” do not change while the facility is being designed and built. Much of the effort expended in the reviews of WRAP was associated with the changed requirements for Hazard Category 2 facilities versus Low Hazard facilities. For instance, these changes in requirements and categorization necessitated facility modifications to make the Fire Hazards Analysis on the as-built facility match current standards.

Changes in the overall Hanford waste treatment strategy impact current perceptions about WRAP. When the design activities commenced, WRAP was one of several planned integrated treatment facilities co-located in the 200 West Area. As a result, some extra sophistication and complexity was designed into WRAP, such as AGVs and computerized container tracking systems to facilitate automated transfers between facilities. These strategic changes, coupled with the need to conservatively design the facility to accommodate worst case waste containers, make WRAP appear to be more complex than the routine part of its current mission would require.

Another major issue has to do with cultural changes in attitudes among workers. Current regulations require strict adherence to safety commitments made in the FSAR and other authorization basis documents. This philosophy requires more attention to careful implementation of procedures and good conduct-of-operations practices. Management ability and willingness to force required improvements and cultural changes are also essential.

In addition to the foregoing types of issues, there are also physical equipment lessons learned. Unexpected interactions between the AGV laser guidance system and reflective surfaces on the stainless steel and glass ports on the process enclosures “confused” the AGV and caused it to go into its “lost” mode. Because of commitments to the State regulatory agencies, WRAP was under considerable time pressure to get started. Because of these pressures, some of the equipment installations and pre-operational tests were rushed, and integrated acceptance tests of the entire processing system were foregone until startup was imminent. For instance, to accommodate the construction schedule, rushed delivery of the individual glovebox components before completion of final integrated shop testing was performed at the fabrication facility led to fit-up and integration problems that had to be resolved on site. This caused last minute design changes that were rushed into place to remedy operational concerns. Some design concerns were also identified during the reviews, including questions on the ability to test the dry powder fire extinguishers mounted on the process enclosures and use of glove port covers.

Instrumentation issues discovered during startup included the relatively ubiquitous problems associated with radon gas accumulations from the concrete construction materials activating continuous air monitors. The computerized inventory tracking system for the TRU process enclosures was found to be susceptible to counting and calibration uncertainties as waste in 320 liter overpacks was assayed in and reassayed after processing in new 208 liter drums. The computer programs required revisions to properly account for uncertainties and eliminate apparent negative inventories.

As operations commenced, the need to comply with the rigorous safety requirements and commitments while learning how to operate the state-of-the-art equipment caused productions rates to be quite low. However, as more experience is gained and good operational practices are achieved, throughput will increase, allowing WRAP to become part of the solution to the problem of adequately characterizing and processing wastes for disposal.

Table 1. Content Profile for Typical Retrievably Stored Suspect Transuranic Containers.

Waste material	Quantity (vol %)
Metal	22
Lead	Trace
Dirt	2
Filters	1
Wood	2
Concrete	2
Glass	2
Absorbent	2
Subtotal hard waste	33
Rubber	8
Plastic	27
Paper	20
Cloth	6
Subtotal soft waste	61
Other	6
Total (hard waste + soft waste + other)	100

vol% = volume percent.

Table 2. Transuranic Content of Typical Stored 208-Liter Drums. *

TRU (g)	Number of drums	% of drums	Cumulative %
<0.080	18,390	47.33	47.33
0.08 to <0.100	176	0.45	47.78
0.10 to <1.0	2,261	5.82	53.60
1.0 to <10.0	11,638	29.95	83.55
10.0 to <20.0	2,247	5.78	89.33
20.0 to <30.0	639	1.64	90.97
30.0 to <50.0	903	2.32	93.29
50.0 to <75.0	656	1.69	94.98
75.0 to <100	502	1.29	96.27
100 to <125	333	0.86	97.13
125 to <150	257	0.66	97.79
150 to <175	316	0.81	98.60
175 to <200	500	1.29	99.89
200 to <225	30	0.08	99.97
225 to <250	10	0.03	100.00
250 to <300	0	0	100.00
300 to <400	1	0	100.00
Totals	38,859	100.0	--

TRU = transuranic.

g = gram.

< = less than.

% = per cent.

Total grams of TRU = 4.17 E+05.

Average = 10.7 grams per drum.

*Source: WHC-SD-WM-TI-517.

Table 3. Mixed Fission Product Distribution of Typical Stored 208-Liter Transuranic Drums. *

Ci range	Number of drums	% of drums	Cumulative %
<0.01	26,355	72.74	72.74
0.01 to <0.10	9,021	24.90	97.64
0.10 to <0.20	365	1.01	98.65
0.20 to <0.50	87	0.24	98.89
0.50 to <1.0	139	0.38	99.27
1.0 to <10.0	130	0.36	99.63
10.0 to <50.0	15	0.04	99.67
50.0 to <100	2	0.01	99.68
100 to <150	0	0	99.68
150 to <200	0	0	99.68
200 or greater	118	0.31	100.00
Totals	36,232	100.00	-

MFP = mixed fission product.

TRU = transuranic.

< = less than.

% = percent.

Total curies of MFP = 3.67 E+04.

Average value of MFP for drums containing MFP = 1.0 curies per drum.

Maximum MFP in any drum = 313 curies.

Values are for undecayed MFP (i.e., values entered into burial records).

*Source: WHC-SD-WM-TI-517.

Table 4. List of Potential Hazardous Materials
in the Retrieved Waste Feed Stream.*

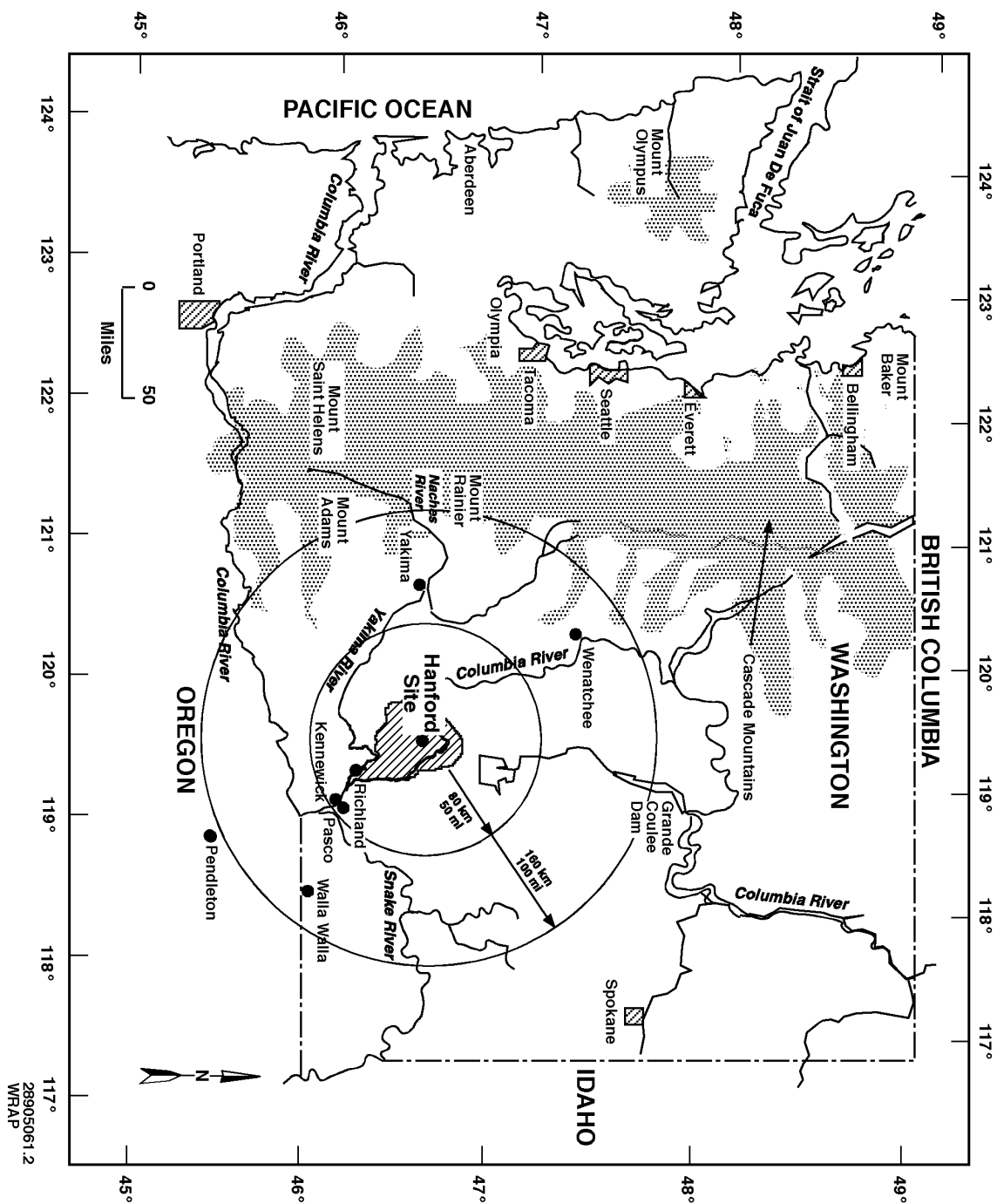
Hazardous material	Total number of containers	No. of cont. with amounts listed	Max. amount in one cont. (kg)	Median (kg)
Ammonia	5	5	0.4500	0.4500
Ammonium nitrate	3	3	7.8900	7.4400
Beryllium	1,006	118	7.0000	1.8144
Cadmium	159	157	89.9923	0.0003
Cyclohexane	6	4	3.7500	2.2200
Dioxane	2	1	25.2196	25.2196
Hydrogen peroxide	4	4	0.4999	0.1000
Indole-2-C14 picrate	1	1	<0.0001	<0.0001
Manganese	2	2	0.0600	0.0400
Mercury	220	184	43.5446	0.0410
Naphthylamine tritium	1	1	102.0600	102.0600
Nitric acid	177	149	34.9990	0.0200
Phosphoric acid	205	44	49.9856	2.9996
Propane	1	1	0.8999	0.8999
Sodium	7	2	2.5601	1.2821
Sodium hydroxide	3,030	3,011	37.1900	0.0004
Sodium hypochlorite	1	1	0.0075	0.0075
Sodium oxide	16	16	48.2600	48.2600
Styrene/styrene monomer	6	6	2.7501	0.5561
Tetrahydrofuran	6	6	1.3499	0.0007
Tetralin	1	1	<0.0001	<0.0001
Uranyl nitrate hexahydrate	7	7	6.1099	0.6999
Vinyl ester/acetate resins	4	4	2.7501	0.9500
Vinyl chloride/resins	11	11	4.0960	0.4536
Zirconium	752	187	0.8600	11.6421

kg = kilogram.

< = less than.

*Source: WHC-SD-WM-RPT-056.

Figure 1. The Hanford Site in Washington State
(Source: WHC-SD-W112-RPT-001).



KILOMETERS = MILES MULTIPLIED BY 1.6094.

Figure 2. Location of the 200 West Area at the Hanford Site
(Source: WHC-SD-W112-RPT-001)

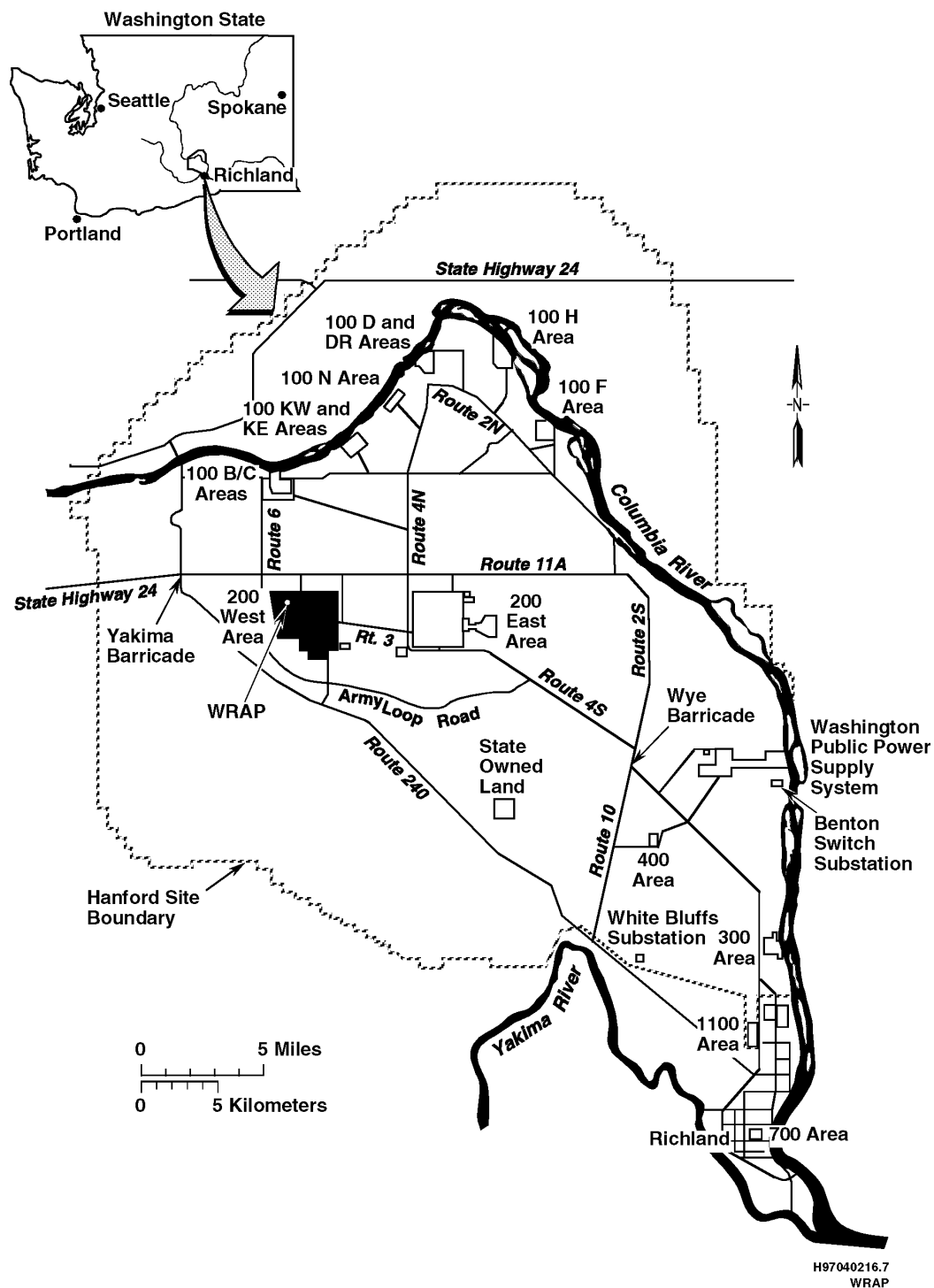


Figure 3. WRAP Vicinity in 200 West Area

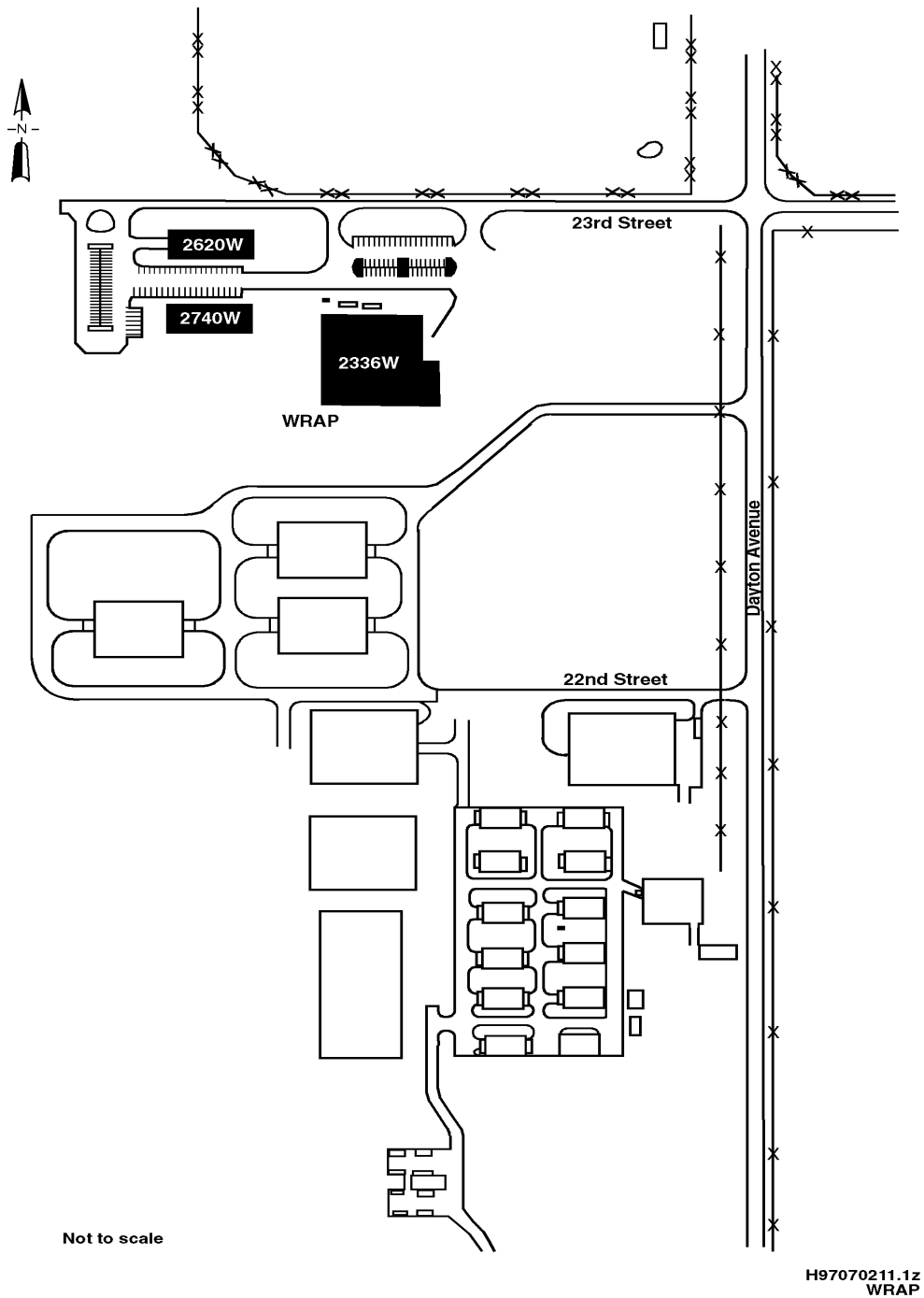




Figure 4a. Exterior view of process enclosure enclosure with drum

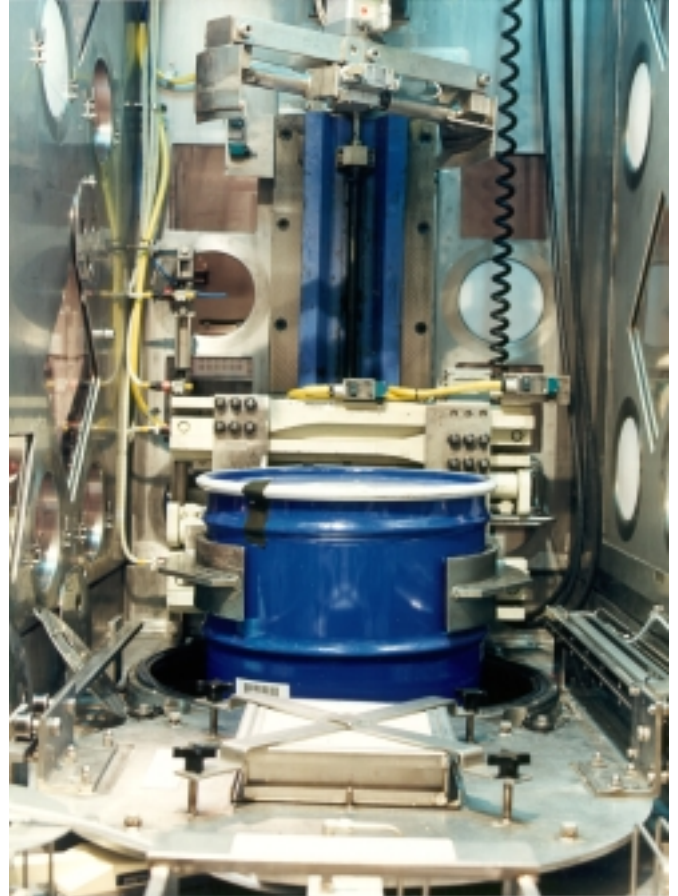


Figure 4b. Interior view of process