

LA-UR-00- - 3854

**The Omega West Reactor
and
Water Boiler Building, TA-2-1;
A Preliminary Report**

Historic Building Survey Report No. 186

Los Alamos National Laboratory

**August 14, 2000
Survey No. 814**

Prepared for the Department of Energy
Los Alamos Area Office

prepared by

**Ellen D. McGehee
And**



Kari L. M. Garcia
Cultural Resource Managers



ESH-20 Cultural Resources Team
Environment, Safety, and Health Division
LOS ALAMOS NATIONAL LABORATORY

Introduction:

In accordance with the Emergency Situations procedures contained in 36 CFR 800.12, the following information has been prepared as part of the notification of an adverse effect to TA-2-1, a historic LANL property. The proposed emergency action (detailed below) stems from an increased risk of severe flooding in the aftermath of the Cerro Grande fire.

Background Information:**Physical Description – Omega Site and Building TA-2-1**

Technical Area (TA) 2, Omega Site, is a small technical area located in the bottom of Los Alamos Canyon, Los Alamos, New Mexico. This technical area consists of a single main building (TA-2-1). In recent months, other support structures located at this abandoned facility have been removed. TA-2-1 has housed five nuclear reactors between 1944 and 1994. The eastern half of TA-2-1, a wooden building with a high bay, was constructed in 1944. The western half is a two-story addition that was built in 1946 out of concrete block (see-attached map, photos and drawings).

Brief Historical Background

The eastern half of TA-2-1 was built in 1944 during the Manhattan Project at Los Alamos. It was originally known as the Water Boiler building because it was built to house the first water boiler reactor, LOPO (low-powered). This reactor was the world's third reactor. It was also the first homogeneous liquid-fueled reactor and the first reactor to be fueled by enriched Uranium-235. LOPO produced the first self-sustaining nuclear chain reaction using enriched uranium on May 9, 1944. The original use of this reactor was for critical mass calculations in support of the first uranium bomb. A higher power version of this reactor was eventually needed to serve as a source of neutrons that would roughly represent the neutron spectrum from an atomic weapon (Garcia 1999).

LOPO was dismantled and a second water boiler reactor was functioning by the end of 1944. This second reactor, HYPO (high-powered), was operated until 1951, when HYPO was converted into SUPO (super-powered). This version was in operation until 1974, when it was deactivated. SUPO's neutrons were used for many measurements important to the national weapons program (Garcia 1999). The Water Boiler portion of TA-2-1 also contained office spaces, other general laboratory space, and a vault for the storage of fuel rods. In 1990, the American Nuclear Society declared the Los Alamos Water Boiler Reactor (1944 – 1974) to be a Nuclear Historic Landmark. A plaque commemorating this declaration was placed on the wall of the former control room in the Water Boiler portion of TA-2-1.

In 1946, the "Clementine" Reactor was constructed in a new addition to the Water Boiler building. This reactor was a fast-neutron research reactor that used plutonium fuel surrounded by mercury coolant. Clementine was the world's first fast plutonium-fueled

reactor and it reached full operational power in 1949. This reactor's fast neutrons were used in weapons experiments. In 1952, Clementine was shut down after a fuel element failure contaminated the mercury coolant with plutonium. The reactor was dismantled in 1954 (Garcia 1999).

The final reactor at the Omega Facility, the Omega West Reactor, was built on the foundations of Clementine in the western half of TA-2-1. This water-cooled research reactor went critical in 1956. The Omega West Reactor was designed primarily to facilitate experimentation in nuclear physics and other sciences. The largest single use of this reactor was neutron activation analysis. The Omega West Reactor was shut down in 1992 when a leak was discovered. Omega Site has been closed since 1995 (Garcia 1999).

Daghlian Criticality Accident

On August 21, 1945, a critical assembly was being created at Omega Site by hand stacking tungsten-carbide bricks around a plutonium core. When the researcher, Harry Daghljan, moved the final brick over the assembly, he noticed that the addition of the brick would make the assembly supercritical. The brick slipped and fell onto the assembly and the system became super-prompt critical. Daghljan removed the brick and unstacked the assembly. The power excursion gave him an exposure of approximately 510 rem and he died 28 days later (Stratton rev. Smith 1989).

Potential for Contamination

At TA-2-1, contaminated areas in the Omega West Reactor portion of the building include the top of the reactor tank and the roof above the reactor tank. The Water Boiler portion of the building is also contaminated: the concrete-capped floor of room 123 (where the LOPO reactor was located), other areas in room 123, and areas in room 122 (where the HYPO and SUPO reactors were located) (Garcia 1999).

Principal radionuclides normally remaining in reactor cooling water systems are tritium and cobalt 60. Other possible contaminants from the operations of the Omega West Reactor and other reactors include cesium-137, technetium-99, mercury, chromium, and total uranium and isotopic plutonium (Garcia 1999).

Eligibility Recommendation:

The Water Boiler reactors at TA-2-1 provided critical mass data in support of Manhattan Project nuclear weapons development. The three Water Boiler reactors and the later, Clementine reactor, were prototype nuclear reactors and represent important stages in the development of modern reactor technology. For these reasons, TA-2-1 is considered a historically significant property and is eligible under Criterion A. The property is considered eligible although it has suffered a loss of interior integrity from past cleanup activities, especially in the Water Boiler portion of the building where none of the water boiler reactor equipment remains.

Proposed Emergency Action:

The wooden portion of TA-2-1 is being considered for emergency removal because severe flooding in Los Alamos Canyon could release radiological contamination into the environment, causing a threat to human health. The risk of flooding at TA-2 has increased dramatically as a result of the Cerro Grande Fire and projected runoff in the canyon during a 100-year storm event is predicted to be in excess of 2180 cubic feet per second. These values are approximately four times the flows expected for a 100-year storm prior to the fire.

Proposed Mitigation Measures:

Adverse effects to properties determined eligible for the National Register should be mitigated to the fullest extent possible. Additional detailed documentation (outlined below) should serve to mitigate the adverse effects to this property.

Both portions of the building will be documented to a level consistent with HABS Level II standards.

- 1) A New Mexico Historic Building Inventory Form will be prepared.
- 2) Historical building drawings and current as-builts, both plans and elevations, will be assembled.
- 3) Archival large-format black and white photographs will be taken of the building's interior and exterior. Large-format negatives will be stored at LANL's photo archives. Additional 35mm and/or digital photographs will be taken to supplement the black and white prints.
- 4) Any salvageable artifacts will be identified and removed. Artifacts will be curated at the Bradbury Science Museum or at ESH-20 storage facilities.
- 5) Historical research will be conducted using the existing literature, historical documents in LANL's archives, and/or interview data provided by former site workers.

- 6) A written historical context will be prepared along the following lines –

Omega Site Context: Reactor Development at Los Alamos

Possible Themes:

- a) Criticality Research in Support of Nuclear Weapons
- b) Reactor Research and Development
- c) Health and Safety (Criticality Safety and Medical Isotopes)

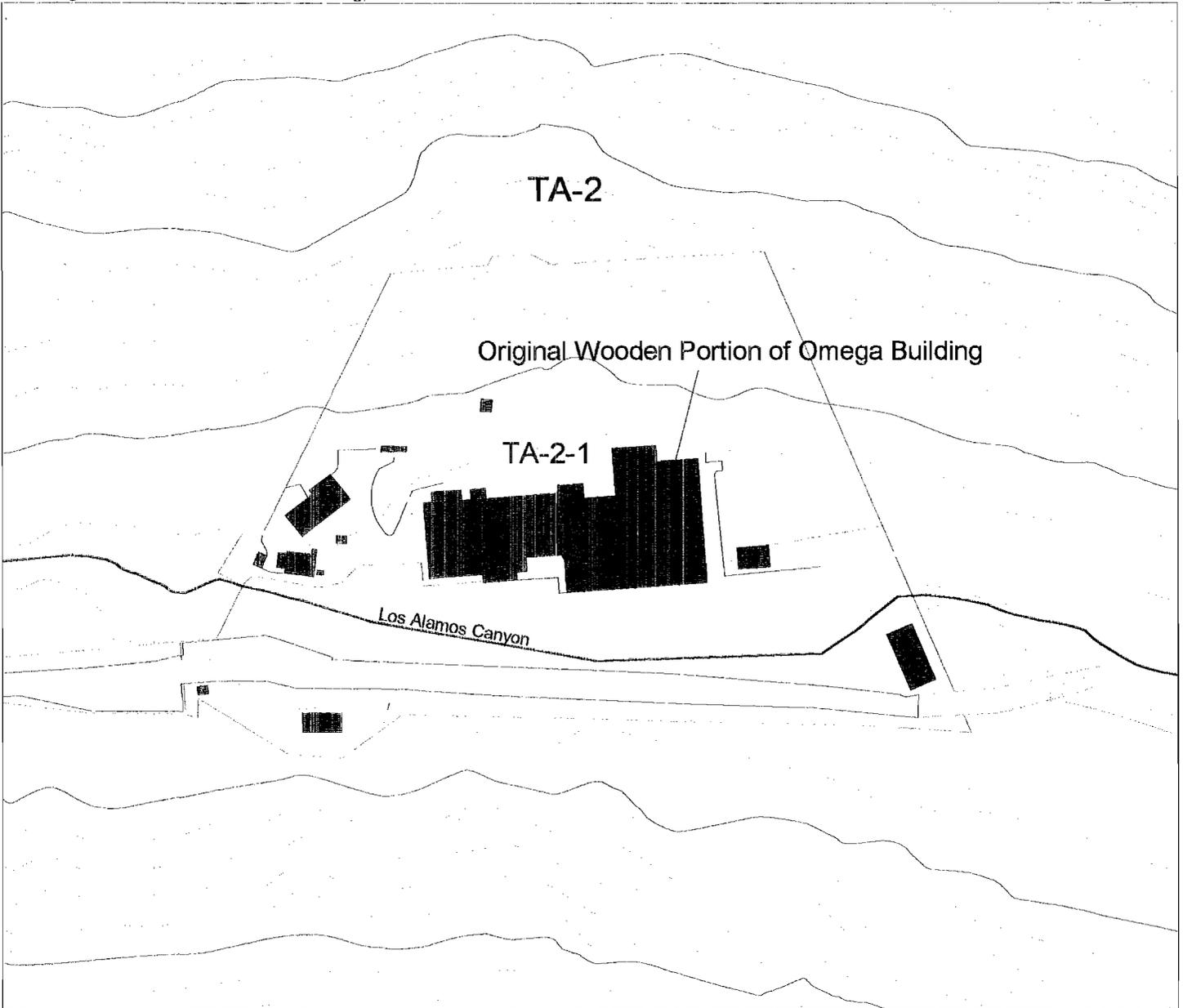
References Cited:

Kari L. M. Garcia

1999 *Decontamination and Decommissioning of Structure 49 and Buildings 57 and 88 at Technical Area 2.* LA-UR-99-798, Historic Building Survey Report No. 162. On file at ESH-20, Los Alamos National Laboratory, Los Alamos, New Mexico.

Stratton, W., rev. by D. Smith

1989 *A Review of Criticality Accidents.* Published by Nuclear Criticality Information System, U.S. Department of Energy, Office of Safety Appraisals, DOE/NCT-4, (originally published in 1967 by then LASL, now LANL).



1:1500

20 0 20 40 60 Meters

100 0 100 200 Feet

Los Alamos
National Laboratory

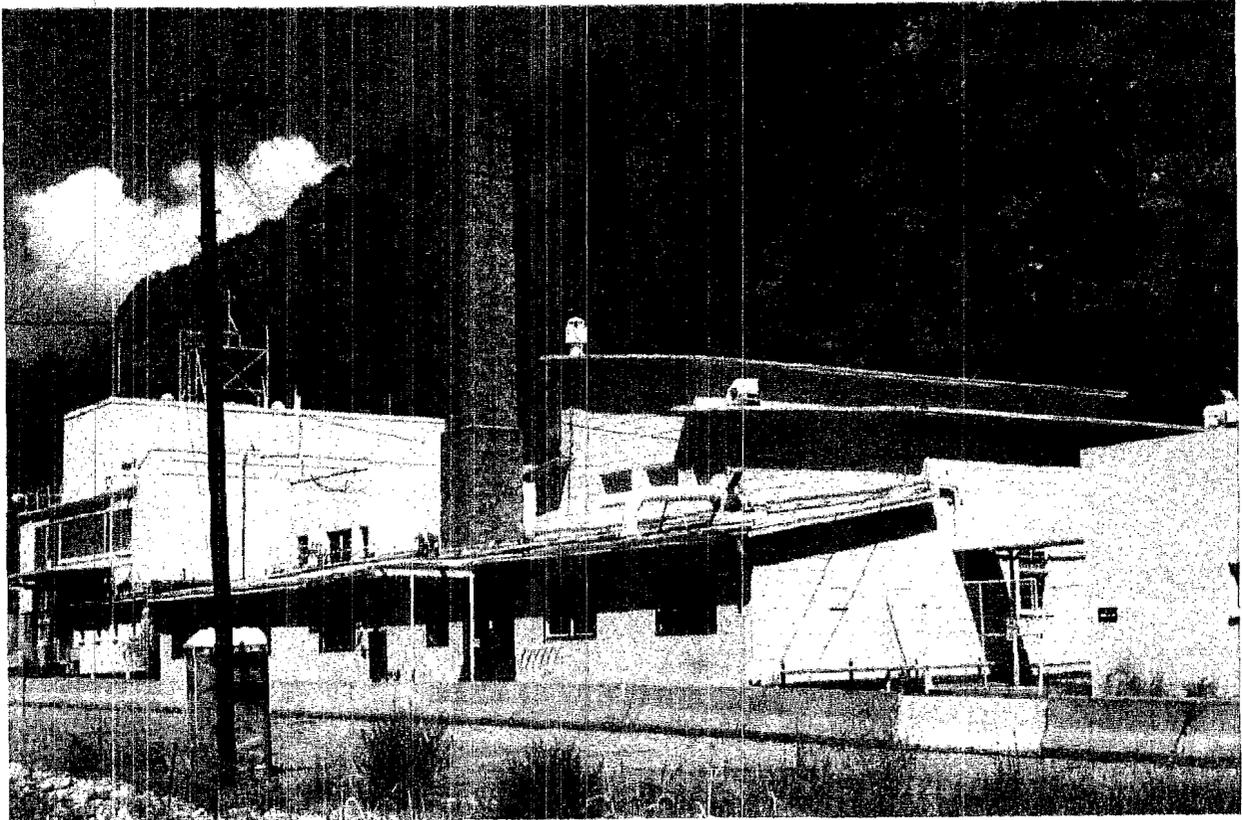
Cultural Resources Team
ESH-20 Ecology Group

TA-2 Omega Site

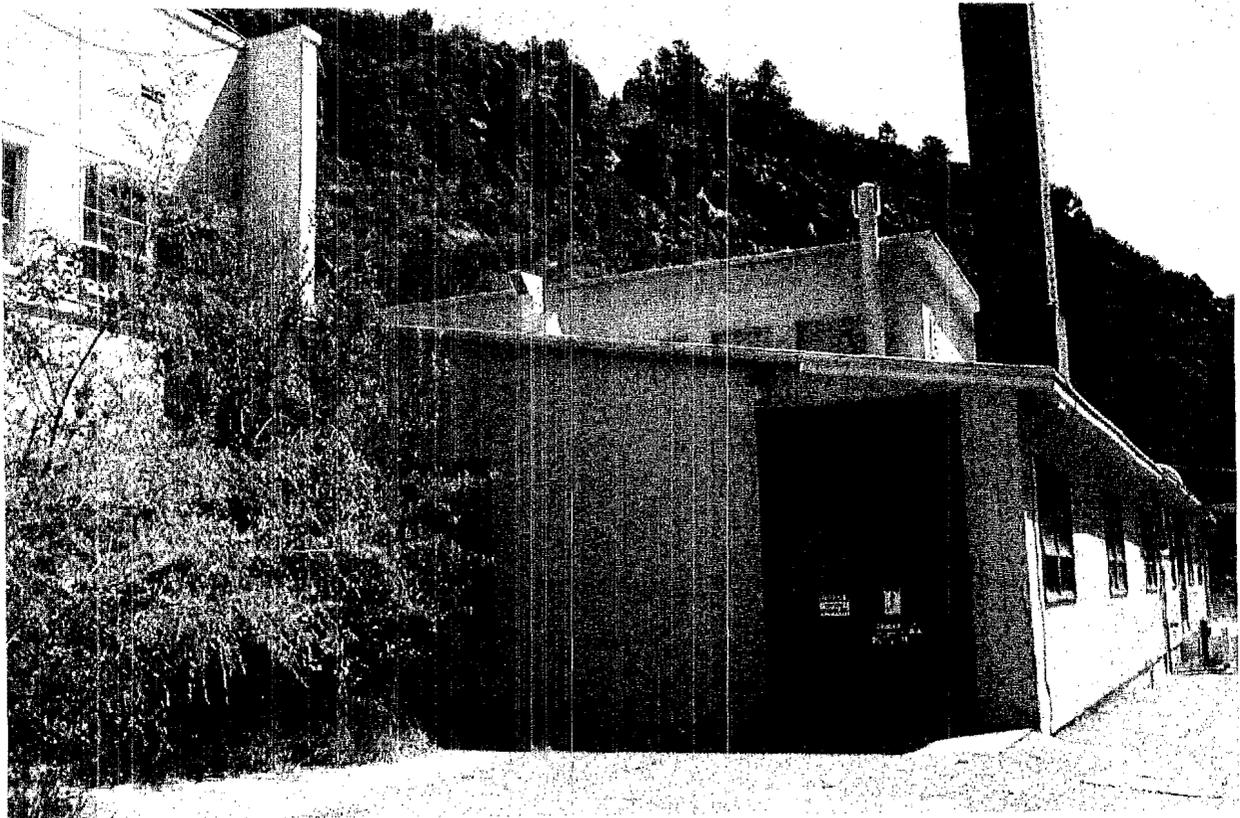
Building TA-2-1



- 20 Foot Contours
- 100 Foot Contours
- Drainage
- Roads
- Road dirt
- Park pave
- Park dirt
- Fences
- Perm bldg



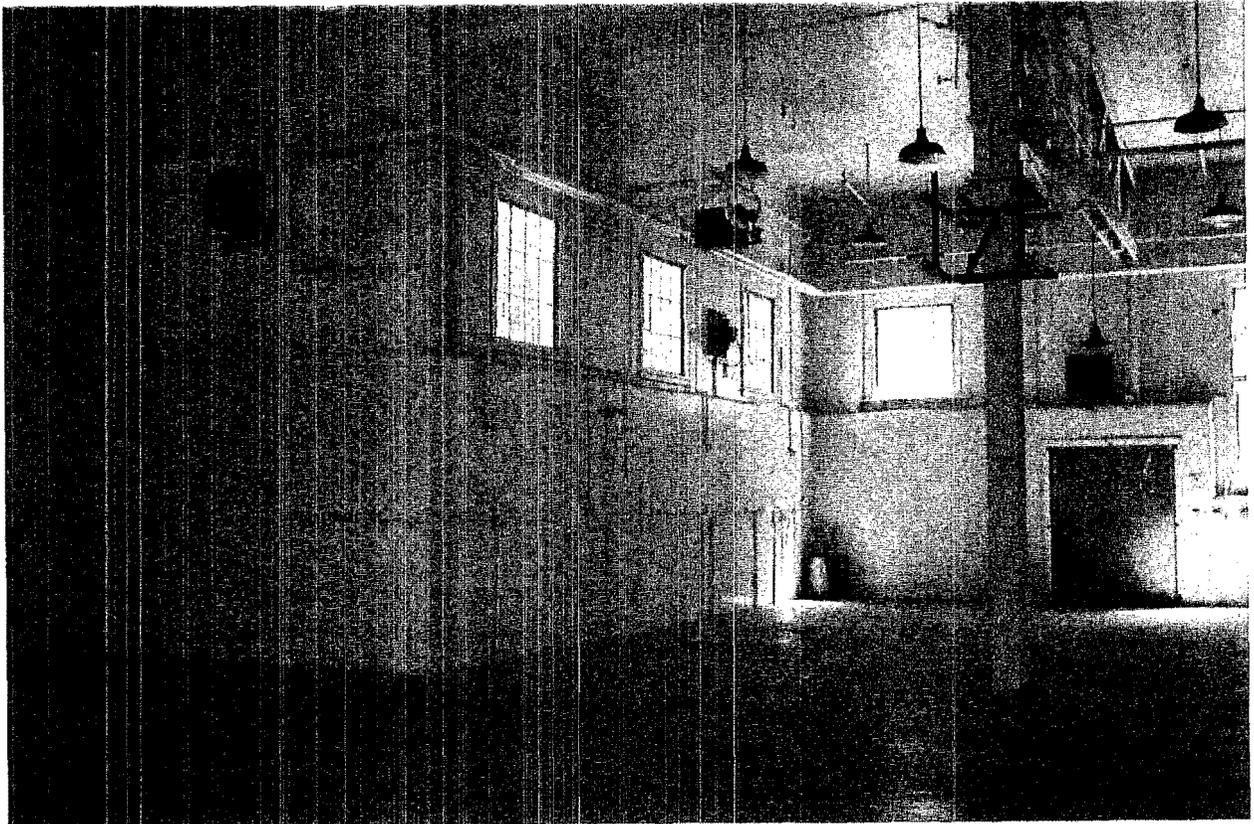
Omega Site TA-2-1



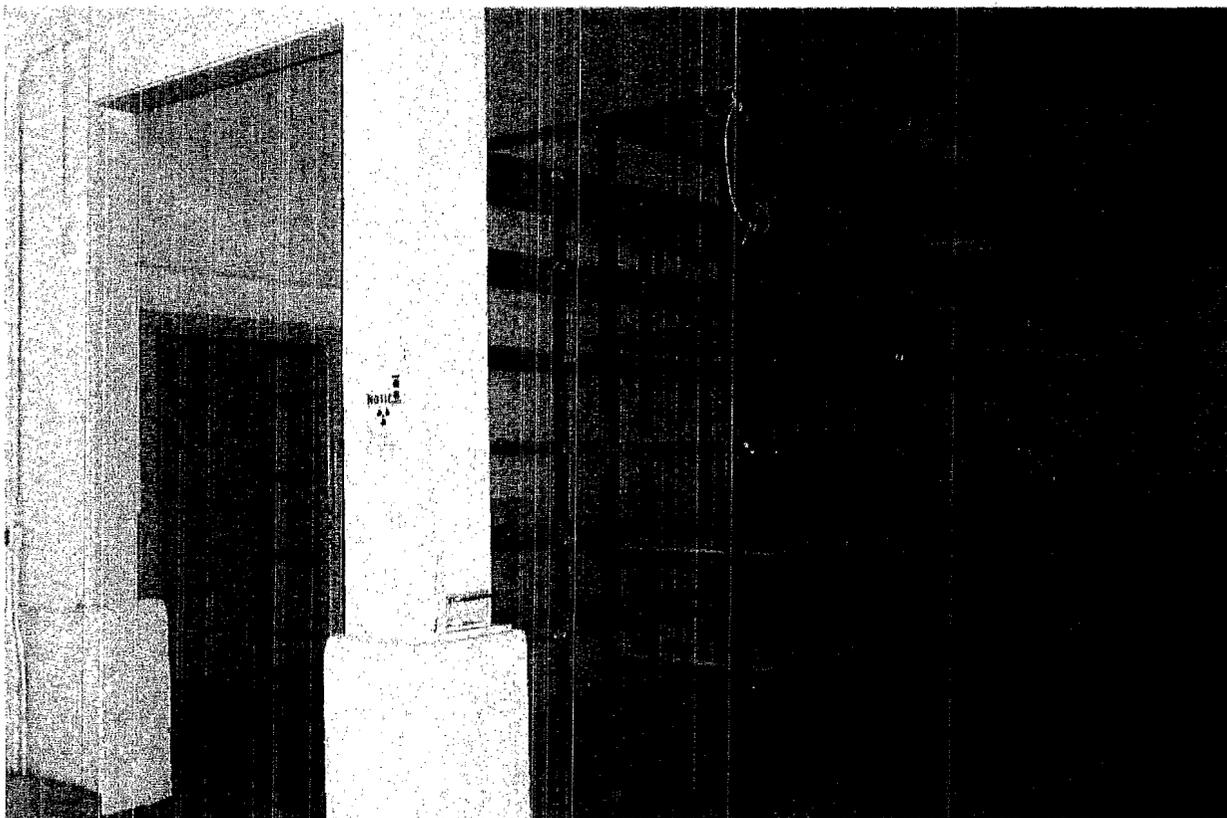
Omega Site TA-2-1



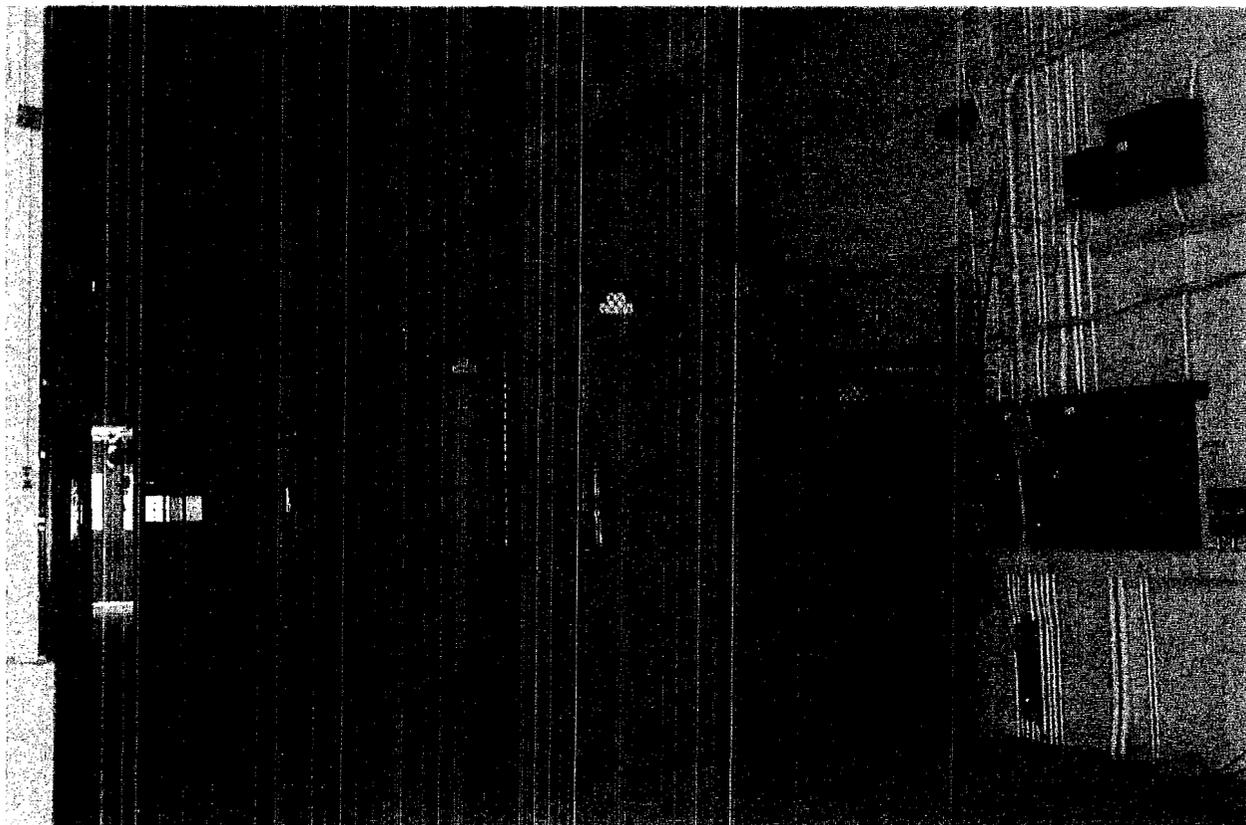
TA-2-1, Room 122



TA-2-1, Room 122



TA-2-1, Room 123



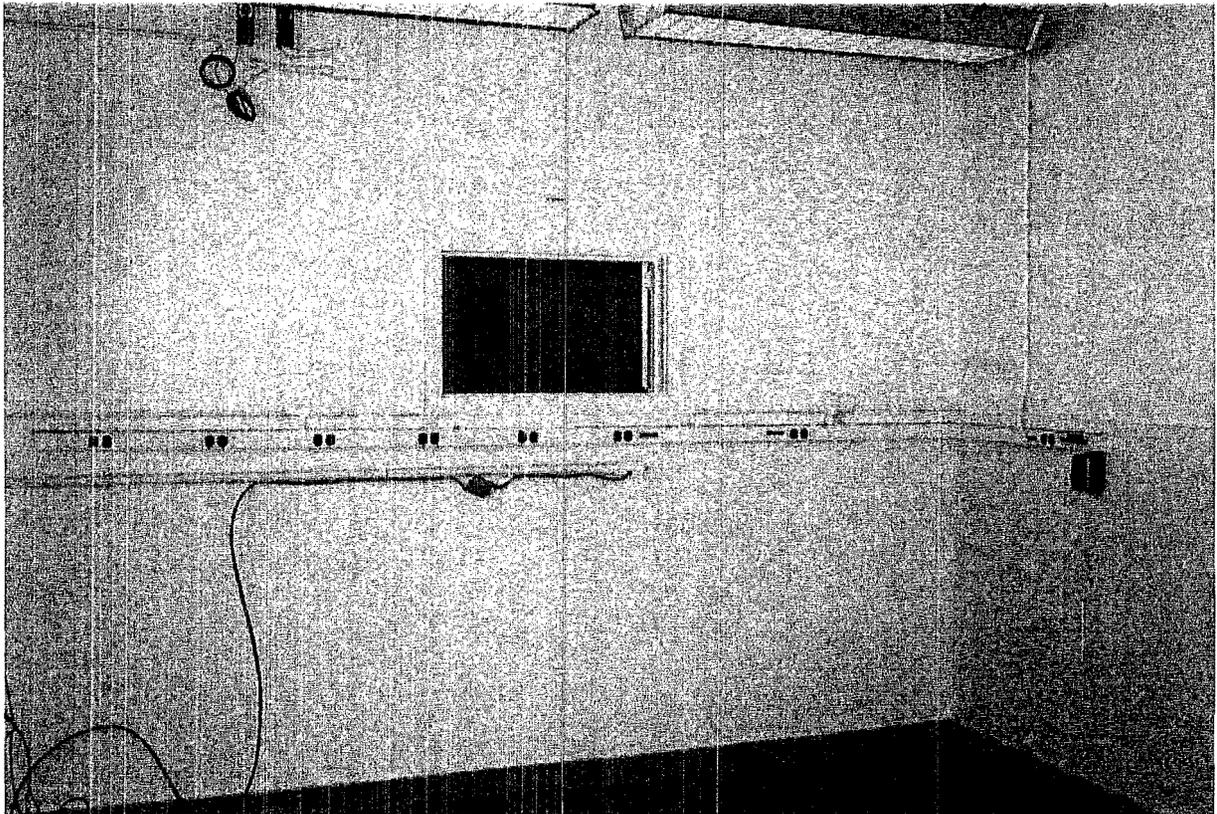
TA-2-1, Room 123



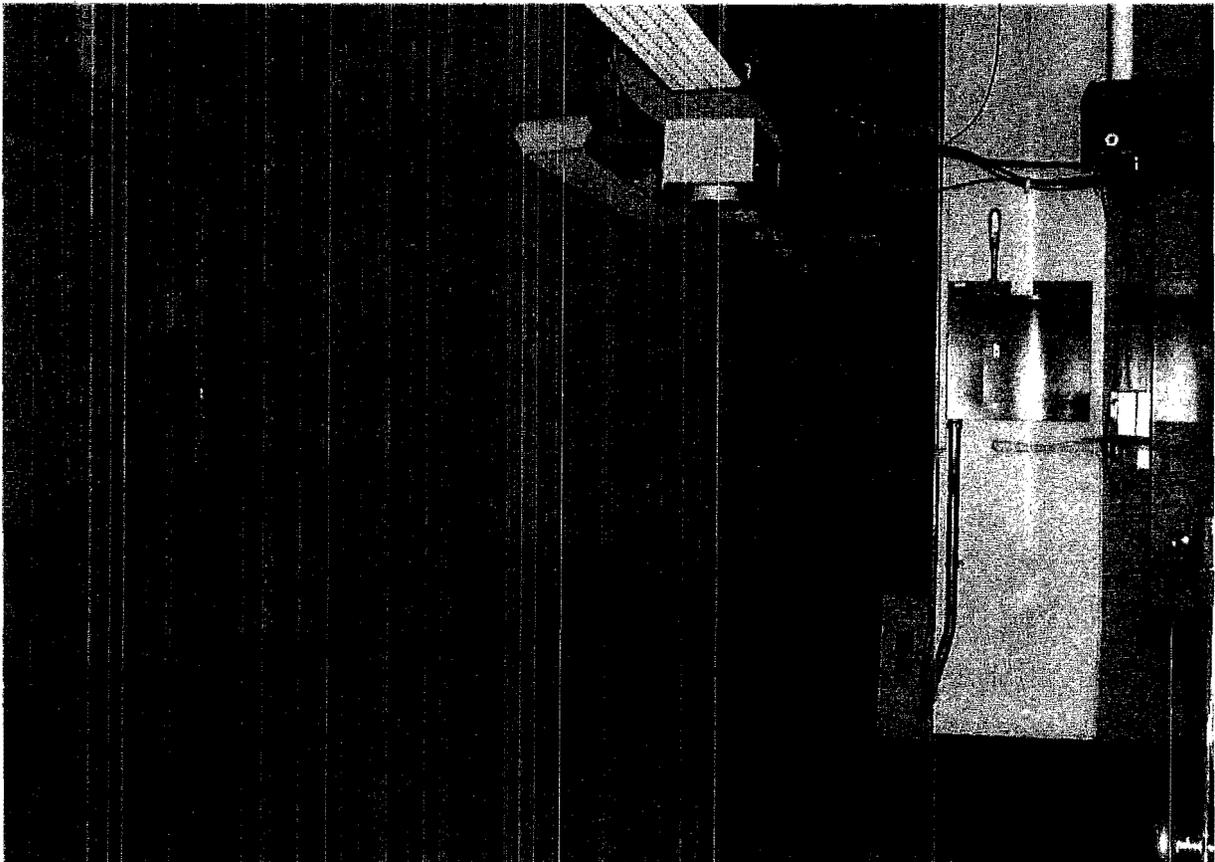
TA-2-1, Room 122



TA-2-1, Rooms 116 & 116A



TA-2-1, Room 119



TA-2-1, Room 121

ROOM INFORMATION CHART

ROOM NUMBER	NET SQUARE FOOTAGE
001	805
ELEV PIT	94
B-STW2	27

TOTAL ROOM NET SQUARE FOOTAGE = 946

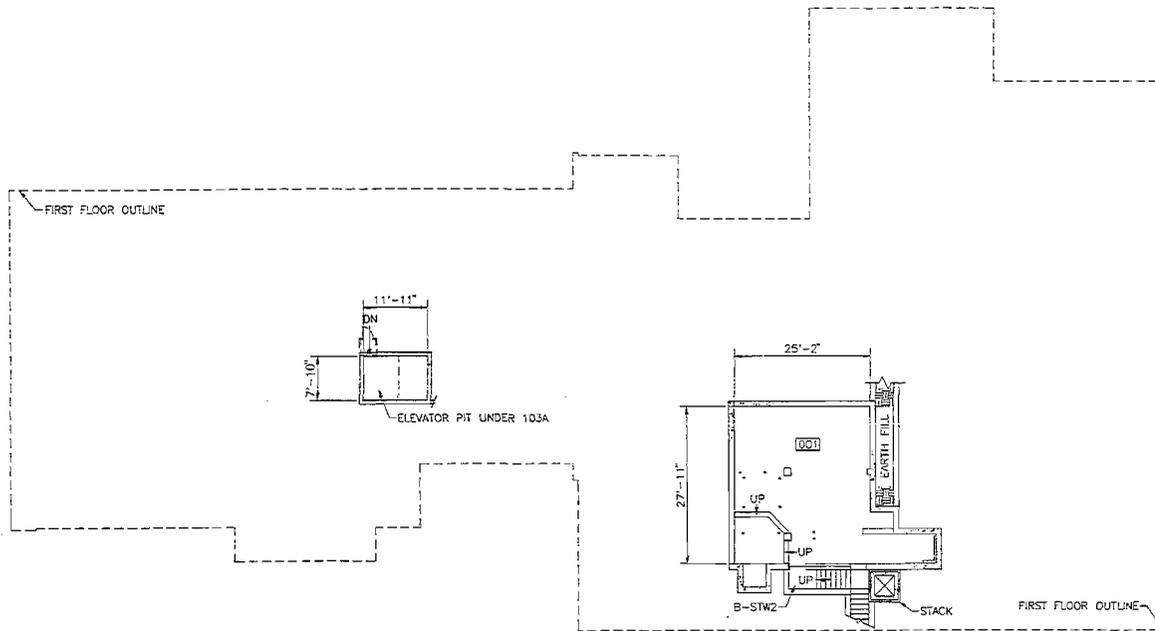
GROSS SQUARE FOOTAGE = 1,123

LEGEND

	CONCRETE
	COLUMNS
	BRICK

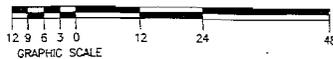
NOTES

- ROOM NET SQUARE FOOTAGE IS COMPUTED BY MEASURING FROM THE INSIDE FACE OF EXTERIOR WALLS TO THE CENTERLINE OF ALL OTHER WALLS.
- GROSS SQUARE FOOTAGE IS EQUAL TO ALL FLOOR AREA (INCLUDING ALL OPENINGS IN FLOOR SLABS) MEASURED TO THE OUTER SURFACES OF EXTERIOR OR ENCLOSING WALLS, AND INCLUDES ALL FLOORS, MEZZANINES, HALLS, VESTIBULES, STAIRWELLS, SERVICE AND EQUIPMENT ROOMS, PENHOUSES, ENCLOSED PASSAGES AND WALKS, FINISHED USABLE SPACE WITH SLOPING CEILINGS (SUCH AS ATTIC SPACES) HAVING 5 FEET OR MORE HEADROOM, AND APPENDED COVERED SHIPPING OR RECEIVING PLATFORMS AT TRUCK OR RAILROAD CAR HEIGHT, ALSO INCLUDED IN GROSS FLOOR AREA, BUT CALCULATED ON ONE-HALF OF ACTUAL FLOOR AREA, ARE COVERED OPEN PORCHES, PASSAGES AND WALKS, WITH APPENDED UNCOVERED RECEIVING AND SHIPPING PLATFORMS AT TRUCK AND RAILROAD HEIGHT.



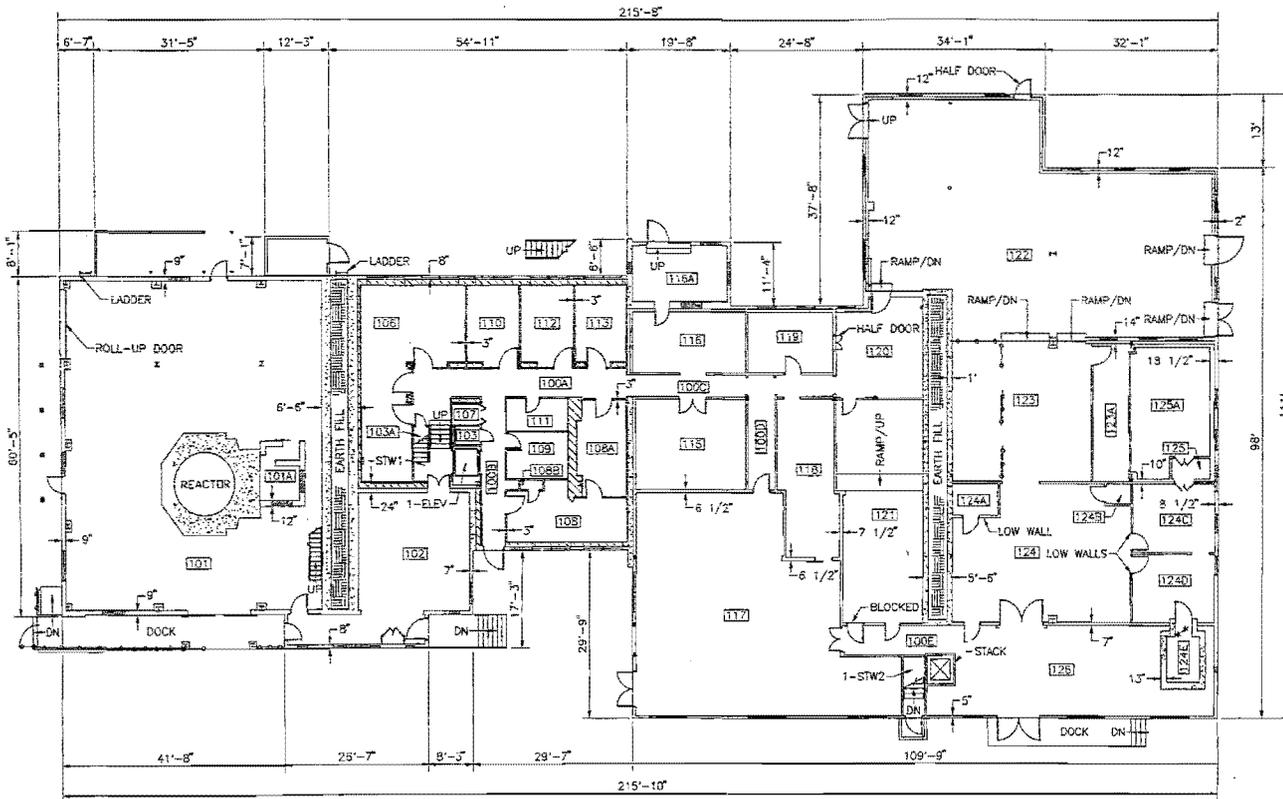
BASEMENT FLOOR PLAN

SCALE: 3/32" = 1'-0"



NO	DATE	CLASS REV	DESCRIPTION	OWN	VER	CHKD	REL	SUB	REC	APP
JOHNSON CONTROLS WORLD SERVICES INC. AS-BUILT RECORD FLOOR PLAN LABORATORY AND OFFICE BUILDING ARCH: BASEMENT FLOOR PLAN										
BLDG 01 SUBMITTED: JERRY FORTE RECOMMENDED: FRED THOMPSON APPROVED: FRED THOMPSON DATE: 10-27-93										DRAWN: C. SALAZAR CHECKED: C. SALAZAR RELEASED: H. SALAZAR
Los Alamos National Laboratory Los Alamos, New Mexico 87545										SHEET 1 OF 3
CLASSIFICATION: U REVIEWER: H. SALAZAR PROJECT ID: 7556										DATE: 73-A-23 DRAWING NO.: AB110

JOI NO 91-011



FIRST FLOOR PLAN

SCALE: 3/32" = 1'-0"



ROOM INFORMATION CHART

RM NO	NET SQUARE FOOTAGE	RM NO	NET SQUARE FOOTAGE
100A	25	116A	200
100B	130	117	1,540
100C	164	118	319
100D	85	119	178
100E	115	120	335
101	2,913	121	2,300
101A	85	122	2,300
102	680	123	457
103	17	123A	181
103A	11	124	829
104	823	124A	71
107	26	124B	20
108	205	124C	20
108A	470	124D	182
108B	8	124E	72
109	97	125	31
110	125	11-SW2	48
111	85	125A	797
112	125	11-SW1	69
113	146	11-SW2	48
114	354	11-ELEV	41
116	283	UTILITY	152

TOTAL ROOM NET SQUARE FOOTAGE = 15,997

GROSS SQUARE FOOTAGE = 16,554

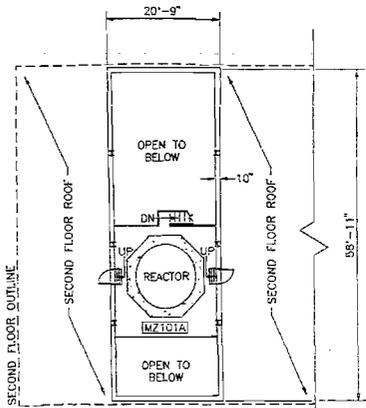
LEGEND

	CONCRETE
	CONCRETE BLOCK
	LOUVER
	WOOD OR METAL STUD
	WINDOW
	COLUMNS
	WIRE MESH PARTITION
	I BEAM
	BRICK
	3" METAL PARTITION
	UTILITY

NOTES

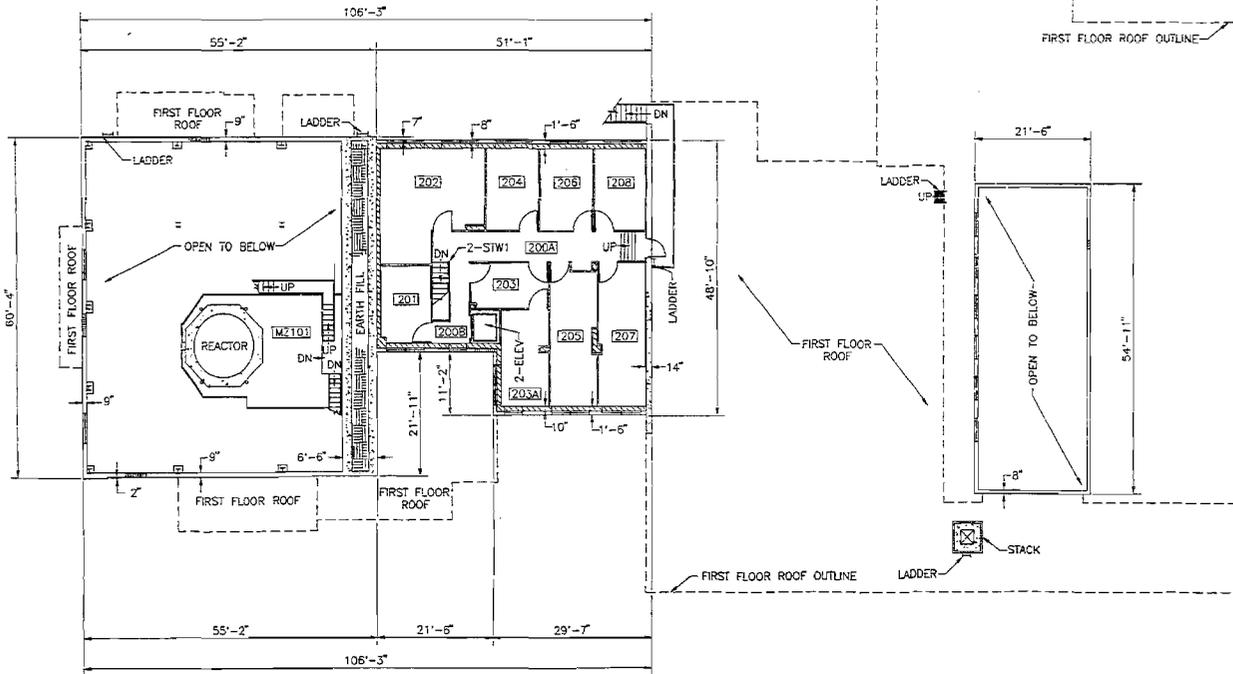
- ALL INTERIOR WALLS ARE 4 1/2" THICK UNLESS OTHERWISE NOTED.
- REFERENCE DRAWINGS ENG-C1623, ENG-C1674, AND ENG-R3333.
- ROOM NET SQUARE FOOTAGE IS COMPUTED BY MEASURING FROM THE INSIDE FACE OF EXTERIOR WALLS TO THE CENTERLINE OF ALL OTHER WALLS.
- GROSS SQUARE FOOTAGE IS EQUAL TO ALL FLOOR AREA (INCLUDING ALL OPENINGS IN FLOOR SLABS) MEASURED TO THE OUTER SURFACES OF EXTERIOR OR ENCLOSING WALLS, AND INCLUDES ALL FLOORS, MEZANINES, HALLS, VESTIBULES, STAIRWELLS, SERVICE AND EQUIPMENT ROOMS, PENNYHOUSES, ENCLOSED PASSAGES AND WALKS, FINISHED USABLE SPACE WITH SLOPING CEILING (SUCH AS ATTIC SPACES) HAVING 5 FEET OR MORE HEADROOM, AND APPENDED COVERED SHIPPING OR RECEIVING PLATFORMS AT TRUCK OR RAILROAD CAR HEIGHT. ALSO INCLUDED IN GROSS FLOOR AREA, BUT CALCULATED ON ONE-HALF OF ACTUAL FLOOR AREA, ARE COVERED OPEN PORCHES, PASSAGES AND WALKS, WITH APPENDED UNCOVERED RECEIVING AND SHIPPING PLATFORMS AT TRUCK AND RAILROAD HEIGHT.

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JOHNSON CONTROLS WORLD SERVICES INC.																
AS-BUILT RECORD FLOOR PLAN LABORATORY AND OFFICE BUILDING ARCH: FIRST FLOOR PLAN																
<table border="0" style="width: 100%;"> <tr> <td>DRAWN</td><td>C. SHADDOX</td></tr> <tr> <td>CHECKED</td><td>P. S. B. / P. S. B. / P. S. B.</td></tr> <tr> <td>RELEASED</td><td>C. SHADDOX</td></tr> </table>											DRAWN	C. SHADDOX	CHECKED	P. S. B. / P. S. B. / P. S. B.	RELEASED	C. SHADDOX
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RELEASED	C. SHADDOX															
BLDG 01 SUBMITTED: JERRY FORTY RECOMMENDED: FRED THOMPSON APPROVED: [Signature] DATE: 10-27-63																
Los Alamos Los Alamos National Laboratory Los Alamos, New Mexico 87545																
CLASSIFICATION: U REVIEWER: [Signature] DATE: 12-4-78 PROJECT ID: 7556 DRAWING NO: AB119																



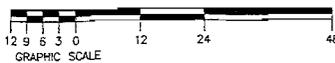
MEZZANINE 101A ABOVE MZ101

SCALE: 3/32" = 1'-0"



SECOND FLOOR PLAN

SCALE: 3/32" = 1'-0"



ROOM INFORMATION CHART			
RM NO	NET SQUARE FOOTAGE	RM NO	NET SQUARE FOOTAGE
200A	182	206	149
200B	110	207	225
201	131	208	142
202	341	MZ101	425
203	121	MZ101A	350
203A	152	2-STW1	33
204	128	2-ELEV	33
205	219	UTILITY	135

TOTAL ROOM NET SQUARE FOOTAGE = 2,927

GROSS SQUARE FOOTAGE = 7,969

LEGEND

	CONCRETE
	CONCRETE BLOCK
	WINDOW
	COLUMNS
	I BEAM
	BRICK
	3" METAL PARTITION
	WOOD AND METAL PARTITION
	UTILITY
	LOUVER

NOTES

1. ALL INTERIOR WALLS ARE 3" THICK UNLESS OTHERWISE NOTED.
2. REFERENCE DRAWINGS ENG-R3334 AND ENG-C1725.
3. ROOM NET SQUARE FOOTAGE IS COMPUTED BY MEASURING FROM THE INTERIOR FACE OF EXTERIOR WALLS TO THE CENTERLINE OF ALL OTHER WALLS.
4. GROSS SQUARE FOOTAGE IS EQUAL TO ALL FLOOR AREA (INCLUDING ALL OPENINGS IN FLOOR SLABS) MEASURED TO THE OUTER SURFACES OF EXTERIOR OR ENCLOSING WALLS, AND INCLUDES ALL FLOORS, MEZZANINES, HALLS, VESTIBULES, STAIRWELLS, SERVICE AND EQUIPMENT ROOMS, PENTHOUSES, ENCLOSED PASSAGES AND WALKS, FINISHED USABLE SPACE WITH SLOPING CEILINGS (SUCH AS ATTIC SPACES) HAVING 5 FEET OR MORE HEADROOM, AND APPENDED COVERED SHIPPING OR RECEIVING PLATFORMS AT TRUCK OR RAILROAD CAR HEIGHT. ALSO INCLUDED IN GROSS FLOOR AREA, BUT CALCULATED ON ONE-HALF OF ACTUAL FLOOR AREA, ARE COVERED OPEN PORCHES, PASSAGES AND WALKS, WITH APPENDED UNCOVERED RECEIVING AND SHIPPING PLATFORMS AT TRUCK AND RAILROAD HEIGHT.

NO	DATE	CLASS	REV	DESCRIPTION	DNW	VER	CHKD	REL	SUB	REC	APP
 JOHNSON CONTROLS WORLD SERVICES INC.											
AS-BUILT RECORD FLOOR PLAN LABORATORY AND OFFICE BUILDING ARCH: SECOND AND MEZZANINE FLOOR PLAN										DRAWN C. SALAZAR	
										VERIFIED C. SALAZAR	
										CHECKED C. SALAZAR	
										RELEASED H. SALAZAR	
BLDG 01		TA-02		DATE		10-27-93					
SUBMITTED JERRY FORTE		RECOMMENDED C. SALAZAR		APPROVED FRED THOMPSON		DATE 11/12/93					
 Los Alamos Los Alamos National Laboratory Los Alamos, New Mexico 87545										SHEET 3 of 3	
CLASSIFICATION PROJECT ID		REVISOR H. SALAZAR		DATE 12-14-93		DRAWING NO. 7556		REV		AB119	