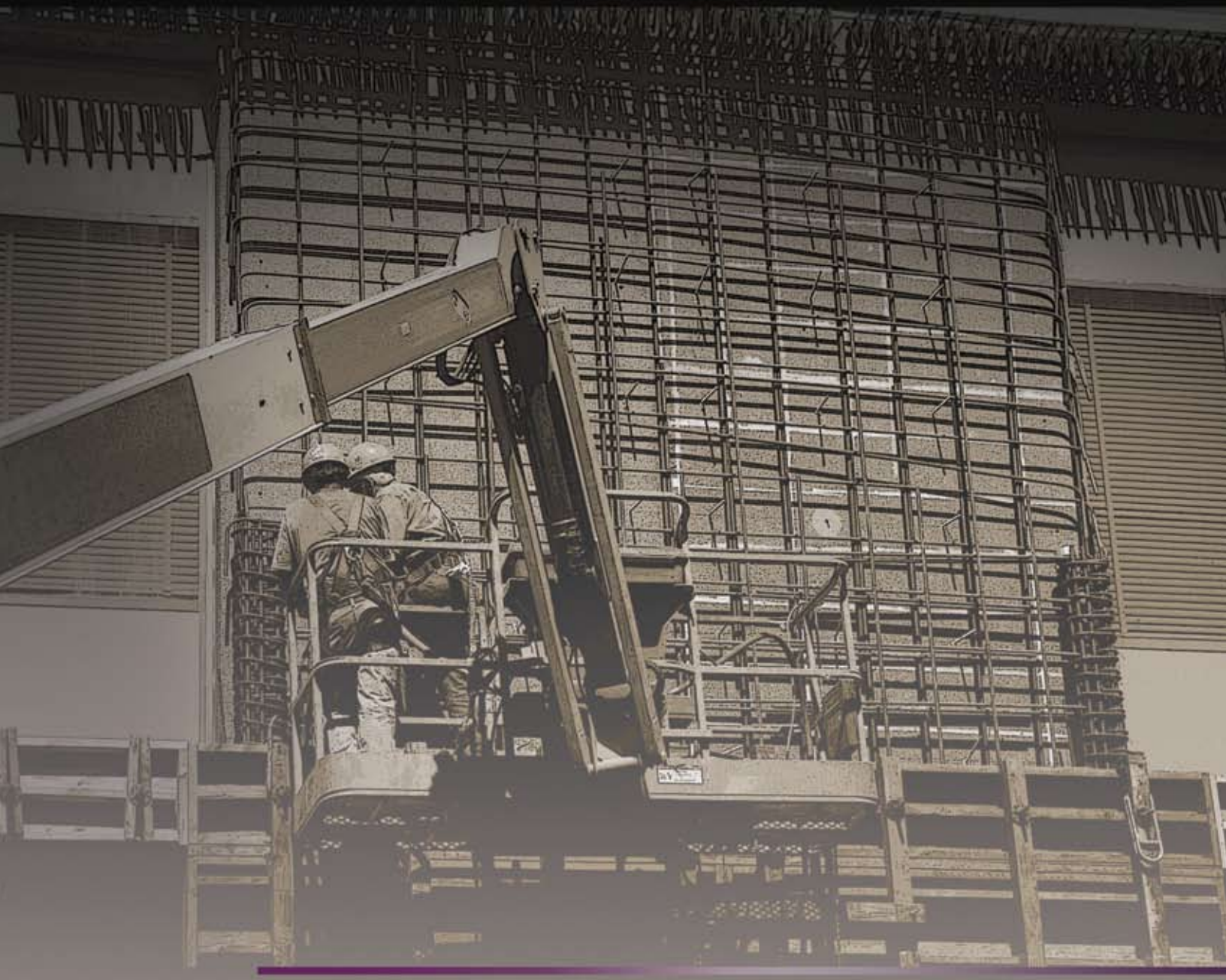
Seismic Safety Study Update



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Introduction

The "Seismic Safety Study" report dated May 2006, UCRL-TR-221420,[1] summarized the findings of the most comprehensive seismic life-safety study performed of the Laboratory's facility inventory.

The study was initiated to comply with the 1991 Presidential Executive Order 12941[2] which required each federal agency to develop an inventory of its facilities and to estimate the cost of mitigating unacceptable seismic risks. The study was completed in 1998 by Degenkolb Engineers.[3]

Degenkolb Engineers was recontracted to assist Laboratory staff to perform additional structural valuations, rank order the facilities based on their level of seismic deficiencies, develop conceptual rehabilitation schemes and cost estimates for the most seriously deficient facilities, and a develop a 10-year seismic mitigation plan. These studies were performed from 1999 to February 2005.[4]

Over the last three years additional facility seismic evaluations and investigations have been completed, much progress has been made toward mitigating seismic life-safety risk to occupants housed in those facilities most vulnerable to be damaged from future earthquakes, and a revised 10-year seismic mitigation plan has been developed.

The purpose of this publication is to document the effort completed over the last three years and to integrate the findings with those reported in the May 2006 report.

Table 1 highlights the significant progress the Laboratory has made toward seismic mitigation of its facilities since the 1970s. Major facility rehabilitations alone have totaled more than $30 million.

Table 1. Highlights of seismic mitigation progress over the last four decades.

Major Facility Structural Rehabilitation	111, 112, 113, 141, 151, 217, 233, 251, 261 (partial), 298, 311, 313, 321C, 323, 331, 332, 381, 415, 493, 511 (partial), 873, 874, 875, 880
Facilities Demolished	261 vault, 377, 431N
Facilities Vacated	241, 326, 435
Other Major Seismic Efforts	• Developed site-specific ground motion criteria for Site 200. • Established and implemented seismic standards for anchoring trailers, ceiling fixtures, bridge-crane earthquake restraints, mechanical equipment tie-down, seismically activated gas shut-off valves and elevator repair. • Performed comprehensive structural evaluations of higher hazard facilities. • Established and implemented emergency procedures and drills. • Performed a probabilistic hazard analysis of Site 200. • Completed requirements of Presidential Executive Order 12941. • Installed free-field and facility strong motion sensors at Site 200 and Site 300.

Results

When the LLNL Seismic Safety Study was published in May 2006, there was an inventory of 635 facilities that house people in the Laboratory's Facility Information Management System (FIMS)* database, out of which 58 facilities were identified by Degenkolb Engineers that required seismic rehabilitation. The remaining 577 facilities were judged to not pose a seismic life-safety hazard to people.

Currently, LLNL reassessed its inventory using updated criteria and determined that of the 597 facilities judged to house people, 68 facilities require seismic rehabilitation. The remaining 529 facilities have been judged to not pose a seismic life-safety hazard to people.

The basis for these evaluations followed the national seismic safety performance objectives of Interagency Committee on Seismic Safety in Construction (ICSSC) RP6, Federal Emergency Management Agency (FEMA) 310, and American Society of Civil Engineers (ASCE) 31 for substantial life-safety, utilizing seismic ground motion criteria equivalent to DOE standard (DOE-STD-1020) Performance Category 1 (PC1).[5] Substantially life-safe seismic performance may be summarized by the following:

> Building performance that includes significant damage to both structural and nonstructural components during the design earthquake,** though at least some margin against either partial or total structural collapse remains. Injuries may occur, but the level of risk for life-threatening injury and entrapment is low. People will likely be unable to reoccupy the building for continuous use until structural repairs are completed.

Facility evaluations throughout were based on screening procedures and guidelines as established by the ICSSC RP 6 which was developed to implement the requirements of Executive Order 12941.[6] The evaluation and rehabilitation process consisted of the following steps:

* Total number of facilities in FIMS can vary due to the following circumstances: (1) definition of a facility [e.g., B321A, B321B,and B321C are currently counted as three facilities, while in 2006 they were counted as one], (2) facilities removed [e.g., demolition], and (3) new facilities added.

** An earthquake that has a 10% exceedence probability in 50 years, or approximately 0.2% annually.

1. Screen the facility inventory and classify each facility as exempt or non-exempt.
   - Exempt facilities are those judged to not pose a seismic life-safety hazard to people and need no further consideration.
   - Non-exempt facilities require evaluation to confirm their level of deficiency and whether seismic mitigation is required.

2. Evaluate the building structure of non-exempt facilities for their ability to meet minimum life-safety seismic performance objectives prescribed by FEMA 310 and ASCE 31 (as required by ICSSC RP 6). Note, nonstructural seismic falling hazards have not been evaluated and are not included in this or previous reports.

3. Categorize each of the non-exempt facilities into three priority classification types (A, B, or C) depending on their level of seismic vulnerability and recommended mitigation.
   - Type A facilities do not meet seismic life-safety criteria and should receive the highest priority towards rehabilitation.
   - Type B facilities do not meet seismic life-safety criteria and should receive the next highest priority toward rehabilitation.
   - Type C facilities do not meet seismic life-safety criteria and require rehabilitation when the facility undergoes a major remodeling or modification.

4. Develop rehabilitation concepts and cost estimates for type A and B facilities.

5. Develop rehabilitation plan for type A and B facilities.

As noted earlier, the evaluation process resulted in identifying 68 facilities that require seismic rehabilitation in order to meet life-safety standards. These facilities are shown in Figure 1 and Table 2. Table 2 also provides a brief description of their expected performance and damage state following a major earthquake, rating the facility's seismic vulnerability (1–10) where the number 10 represents the highest and worst.

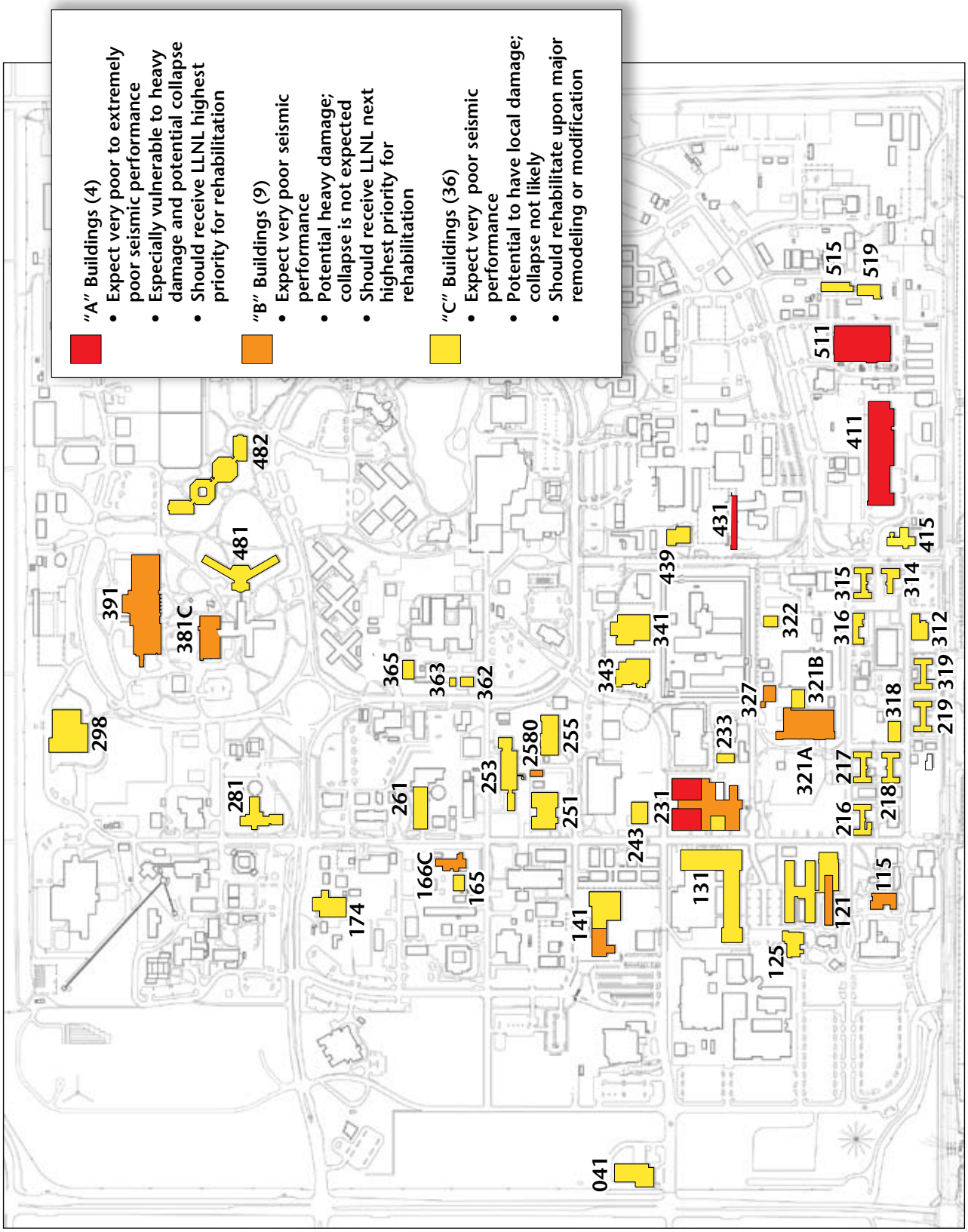

Figure 1. Site 200 facilities not meeting seismic safety standards. (Buildings with multiple vulnerability ratings are counted only once using the highest rating.) Site 300 has 17 type C facilities, but no type A or B facilities.

Table 2. Ranking of 68 seismic deficient facilities (total, increment, or sector) into type A, B, and C classifications.

Type	Recommended Prioritization	Damage State	Expected Performance	Vulnerability Rating	Summary (Total of 67 Facilities)[1]
A	Highest Priority: Facilities are ranked as exceptionally high risk and require active seismic evaluation and mitigation by RP6.[2]	Especially vulnerable to heavy damage. Potential collapse. Does not meet structural criteria.	Extremely Poor	10	
			Very Poor	9	231(G,I),[8] 411, 431,[14] 511[13]
B	High Priority: Strengthen facilities as an active part of the LLNL seismic mitigation program. Determine cost to strengthen, obtain funding, and perform strengthening as funds are allocated. RP6 does not currently trigger action.	Potential for heavy damage. Collapse not expected. Does not meet structural criteria.	Very Poor	8	231(A,B,C,D,E,F,H,M),[1,8] 321A, 391
				7	115,[12] 121,[5,12] 141,[4,13] 166C,[8] 327, 381C,[8,11] 2580
C	Medium Priority: Strengthen as facilities are remodeled and modernized, or as seismic mitigation funding becomes available.	Potential for life threatening local damage. Collapse not likely. Does not meet structural criteria.	Poor	6	041, 117, 121,[1,3,12] 131(II),[6,12] 216, 217,[13] 218, 219, 281, 314, 315, 316, 318, 319, 482, 519, 810A, 810C, 870
				5	141,[1,7] 165, 231(J,K.),[1,8] 233, 253, 261,[15] 321B,[1] 343, 362, 363, 365, 415,[13] 515, 809A, 818A, 826, 827A, 833, 836B, 836D
				4	116,[12] 125,[12] 131,[10,12] 141,[1,9] 174, 243, 251, 255, 298,[13] 312, 322, 341, 439, 481, 827C, 827D, 827E, 865, 873,[13] 874,[13] 875[13]

1 Buildings 121, 141, 231, and 321 have multiple vulnerability ratings. The sectors are shown accordingly in this table, but buildings are counted only once using the highest rating (6 instances in this table).
2 See reference 4 on page 17.
3 North "H" wing (increment I).
4 Sector A, bays 4 and 5.
5 Increment II, south three-story wing.
6 Sector II, south wing addition and offices.
7 Sector B, bays 1 and 2.
8 Letter designation refers to sector of building.
9 Sector D, bay 3, and sector C.
10 Increment I, offices, and increment II north mechanical room.
11 High and low laboratory areas.
12 Revised classification resulting from an updated evaluation (see reference 8 on page 18).
13 Facilities have had partial rehabilitation, but still do not meet life-safety criteria.
14 Includes only southside of original highbay structure (ETA-II wing not included).
15 Sectors 1, 2, and 3 only.

Table 3 shows the results of the screening process. It shows the number of facilities in each exempt and non-exempt category and reason for the exemption.

Table 4 shows where each facility in the FIMS database that houses people fits within the different exempt or non-exempt categories.

Table 5 provides estimated costs for the rehabilitation of type A and B facilities (full, partial, and sectors).

Table 6 presents an updated 10-year seismic mitigation plan which identifies each of the type A and B facilities, cost estimates (where available) for full life-safety upgrades, and proposed action with dates.

Concept level strengthening schemes have been developed by Degenkolb Engineers, other outside structural engineering consultants, or the Laboratory's Facilities and Infrastructure Directorate for type A and B facilities. These schemes were used as the basis for rehabilitation construction cost estimates.

Schemes and cost estimates were developed for each sector within type A and B facilities. Sectors are seismically independent structures within a facility. Additionally, Degenkolb Engineers provided descriptions of potential for partial strengthening. The intent was to identify partial strengthening options that will decrease the seismic vulnerability of each facility, but may not meet the life-safety performance level for the entire structure. The partial upgrade options are narrative and qualitative in nature. No sketches or calculations were performed. The effort was to identify opportunities where partial strengthening is practical and beneficial.

Note, the schemes were developed to achieve a life-safety seismic performance level for an earthquake with a 10% probability of exceedence in 50 years.

Based on the results of Degenkolb Engineers' evaluations, along with the prevailing practice for the disposition of seismically deficient facilities and risk-based evaluations (see the May 2006 Seismic Safety Study), it is concluded that there is no need to evacuate occupants from these 67 facilities prior to the facility rehabilitation.

For quick reference, Tables 7 and 8 are included. Table 7 provides DOE 1021 seismic performance categorization guidelines. Table 8 provides current seismic evaluation, rehabilitation and design criteria for Laboratory facilities.

Results

Table 3. Number of facilities in exempt and non-exempt categories, and reasons for exemptions from Interagency Committee on Seismic Safety in Construction (ICSSC).

Number of Buildings	Code to be Entered	Exemption
68	EO	Building is not exempt.
87	E1	Building is classified for agricultural use, or intended only for incidental human occupancy, or occupied by persons for a total of less than two hours a day. (RP exemption A)
0	E2	Building is a detached one- or two-family dwelling located in an area having governing acceleration coefficients less than 0.15. (RP4 exemption B)
120	E3	Building is a one-story building of steel light frame or wood construction with an area of less than 280 m^2 (3000 square feet). (RP4 exemption D)
11	E4	The building has been fully rehabilitated to comply with Table 1 of RP4 that also complies with the nonstructural, geological/site, and adjacency categories. (RP4 exemption E)
250	E5	The building is a post-benchmark building as defined in Table 1 of RP4 that also complies with the nonstructural, geological/site, and adjacency categories. (RP4 exemption E)
46	E6	The building is a pre-benchmark building that has been shown by evaluation to be life-safe in all four compliance categories. (RP4 exemption G)
5	E7	The building was constructed for the Federal government and the detailed design was done after the date of the adoption of Executive Order 12699 (January 5, 1990) and the building was designed and constructed in accordance with the ICSSC Guidelines and Procedures for Implementation of the Executive Order on Seismic Safety of New Building Construction. (RP4 exemption H)
6	E8	The remaining useful life of the building has been identified as being less than five years.
0	E9	Other. These had only minimal deficiencies and therefore considered to be exempt.
4	E10	Building vacant and not expected to reopen or be reused.
597		Total

Table 4. Facility list by exemption categories.

Exemption	Description of Exemption	Total	Facility Number
EO	Facility is not exempt.	68	041, 115, 116, 117, 121, 125, 131, 141, 165, 166,[1] 174, 216, 217, 218, 219, 231, 233, 243, 251, 253, 255, 261, 281, 298, 312, 314, 315, 316, 318, 319, 321A, 321B, 322, 327, 341, 343, 362, 363, 365, 381,[2] 391, 411, 415, 431,[3] 439, 481, 482, 511, 515, 519, 809A, 810A, 810C, 818A, 826, 827A, 827C, 827D, 827E, 833, 836B, 836D, 865, 870, 873, 874, 875, 2580
E1	Facility is exempt. Facility is intended for agricultural use, or incidental human occupancy, or occupied by humans for less than 2 hours a day.	56	161, 254, 263, 280, 321D, 419, 653, 803, 806C, 813, 819, 827B, 830, 832A, 832C, 832E, 835, OSM1, OSM2, OSM3, OSM4, OSM5, OSM7, OSM8, OSM10, OSM15, OSM21, OSM22, OSM23, OSM24, OSM30, OSM31, OSM32, OSM33, OSM34, OSM35, OSM36, OSM37, OSM38, OSM41, OSM51, OSM52, OSM58, OSM70, OSM71, OSM72, OSM80, OSM82, OSM83, OSM817C, OSM832B, OSM832D, OSM834M, OSM854H, OSM854V, OSM857
E1 **Tents**[4]	Facility is exempt. Facility is intended for agricultural use, or incidental human occupancy, or occupied by humans for less than 2 hours a day.	31	2599, 4199, 4297, 4298, 4299, 4399, 4997, 4997A, 4998, 4999, 5198, 5299, 5399, 5997, 5998, 5998A, 5999, 6197, 6197B, 6198, 6199, 6199A, 6199B, 6199C, 6199D, 6297, 6298, 6298A, 6299A, 6498, 6499
E2	Facility is exempt. Facility is a detached one or two family dwelling located in an area of low seismicity having acceleration coefficients less than 0.15g.	0	
E3	Facility is exempt. Facility is a one-story light steel frame or wood construction with an area less than 3,000 sf.	120	012D, 118, 134, 135, 164, 170A, 173, 182, 195, 196, 196A, 198, 213, 231A, 252, 293, 294, 297, 297A, 317, 321E, 322A, 328, 328B, 373, 376, 379, 406, 444, 446, 518A, 519A, 520, 533, 534, 619, 622, 651, 652, 801B, 804, 809C, 811, 812A, 812D, 816, 817B, 817D, 817E, 817G, 817H, 818C, 821, 823B, 824, 828A, 828B, 828C, 834B, 834C, 834D, 834E, 834F, 834G, 834H, 834J, 834K, 834L, 837, 841, 843B, 845A, 851B, 855A, 855B, 855C, 856, 859, 860, 869, 872, 874A, 874B, 876, 877, 878, 879, 895, 899A, 899B, 1407, 1413, 1492, 1526, 1631, 1727, 1730, 2632, 2801, 2802, 2808, 3175, 3203, 3982, 4316, 4406, 4905, 4906, 4926, 5105, 5125, 5207, 6178, 6301, 6525, 6526, 6901, 8340, 8580, 8710

Table 4. (continued)

Exemption	Description of Exemption	Total	Facility Number
E4	Facility is exempt. Facility has been fully rehabilitated to comply with RP4 seismic safety standards.	11	111, 112, 113, 194, 271, 311, 321C, 323, 331, 332, 611
E5	Facility is exempt. The facility is a post-benchmark facility as defined by RP6.	135	071, 110, 132N, 132S, 133, 170, 179, 181, 191, 194A, 234, 274, 282, 334, 335, 335A, 335B, 336, 337, 366, 367, 378, 382, 383, 473, 494, 509, 514A, 517A, 522, 523, 525, 532, 597, 612A, 615, 616, 624, 663, 691, 848, 1280, 1401, 1402, 1403, 1404, 1405, 1406, 1408, 1456, 1481, 1527, 1578, 1601, 1602, 1632, 1677, 1678, 1680, 1713, 1726, 1736, 1826, 1878, 1879, 1884, 1885, 1886, 1887, 1888, 1889, 1925, 1927, 2127, 2128, 2177, 2180, 2512, 2525, 2554, 2625, 2627, 2679, 2684, 2685, 2687, 2701, 2726, 2727, 2728, 2775, 2777, 2787, 2825, 2925, 3180, 3204, 3226, 3427, 3526, 3527, 3577, 3649, 3751, 3775, 3925, 4187, 5104, 5225, 5226, 5425, 5426, 5477, 5626, 5627, 5976, 5979, 5980, 6127, 6179, 6203, 6325, 6424, 6501, 6575, 6925, 6926, 6929, 6930, 6951, 8726, 8806, 8825, 8826, 8990
E5	Facility is exempt. The facility is a post-benchmark facility as defined by LLNL benchmark standards for 1982.	115	004,[5] 004J, 005, 007, 008, 140, 142, 152, 153, 154, 155, 190, 193A, 197, 211, 235, 256, 272, 312A, 329, 392, 423, 433, 436, 438, 445, 452, 471, 490, 491, 492, 493, 501, 510, 531, 551E, 551W, 571, 581, 582, 591, 597A, 610, 625, 671, 681, 684, 693, 694, 695, 696, 697, 801A, 801D, 809B, 810B, 843A, 845B, 867, 882, 886, 889, 890, 892, 1277, 1541, 1579, 1714, 1735, 1739, 1802, 2552, 3304, 3340, 3555, 4107, 4113, 4128, 4150, 4161, 4182, 4184, 4302, 4352, 4377, 4378, 4382, 4383, 4384, 4385, 4387, 4388, 4475, 4525, 4675, 4576, 4725, 4726, 4727, 4728, 4729, 4924, 5475, 5675, 6205, 6206, 6426, 6527, 6870, 6928, 6989, 7990, 8711, 8724, 8991, 9998
E6	Facility is exempt. The facility is a pre-benchmark facility that has been shown by evaluation to be life-safe in all four compliance categories. The non-structural evaluation has not yet been performed.	46	122, 123, 151, 162, 175, 176, 214, 221, 239, 262, 292, 313, 324, 345, 361, 364, 404, 405, 418, 432, 442, 443, 451, 512, 516, 517, 543, 614, 802A, 812E, 817A, 817F, 823A, 825, 834A, 836A, 836C, 850, 851A, 851C, 854A, 871, 880, 3724, 3725, 3726
E7	Facility is exempt. Facility constructed under ICSSC guidelines/ procedures.	5	242, 264, 368, 453, 583

Table 4. (continued)

Exemption	Description of Exemption	Total	Facility Number
E8	Facility is exempt. The remaining useful life of the facility is less than five years.	6	612, 805, 806A, 806B, 806D, 807
E9	Other. These had only minimal deficiencies and therefore considered to be exempt.	0	
E10	Building vacant and not expected to reopen or be reused.	4	212, 241, 326, 435
Total E0–E10	Facilities that house people.	597	
Other Structures	Non-building structures such as land, site-wide utilities, cooling towers, tanks, and utility buildings identified in FIMS.	161	
Total Table 3		**758**	
Total FIMS	Does not include tents[4] or 004 lease;[5] does include 9998 lease.[6]	**727**	

[1] Only sector C of B166 does not pass life-safety.
[2] Only the high and low laboratory areas of B381 do not pass life-safety.
[3] Includes only south side of original highbay structure (ETA-II wing not included).
[4] Tents are not included in FIMS; therefore, tents are reported separately in this table in Exemption E1 Tents.
[5] Lease 004 is not included in FIMS; it is a leased childcare facility that is not reimbursed by DOE.
[6] Lease 9998 is located in the state of Maryland, managed by LLNL, and is included in FIMS; it has not been reviewed for purposes described in this report, therefore it is not included in this table.

Table 5. Total estimated cost (TEC)[1] of the rehabilitation of type A or B facilities [2] (full, partial and sectors), and type C if sectors of type A or B facilities.

				Partial Upgrade			Full Upgrade	
Facility No.	**Name**	**Sector**	**Type**	**A to B TEC(K$)**	**B to C TEC(K$)**	**A to C TEC(K$)**	**PC1 TEC(K$) Individual Sectors**	**PC1 TEC(K$) Entire Building**
B115	Computation Facility	NA	B	No cost data available at this time.				
B121[3]	PAT Office	Increment II	B	No cost data available at this time.				
		H (Increment I)	C					
B141	Electronic Shops	A[4]	B	No cost data available at this time.				
		B[5]	C					
B166[6]	Develop Laboratory	NA	B	NA	Not an option	NA		146
B231	Development and Assembly	A-E, H	B	NA	5,535	NA	11,620	
		F	B	NA	377	NA	608	
		G	A	1,846	NA	2,498	2,782	
		I	A	1,870	NA	2,521	2,811	
		J	C	NA	NA	NA	59	
		K	C	NA	NA	NA	142	
		M	B	NA	Not an option	NA	574	
		N	C	NA	NA	NA	129	
		B231 All Sectors	A	---	---	---		18,301
B321A	Materials Fab Shop	NA	B	NA	No estimate available	NA		8,858
B321B	Materials Fab Shop	NA	C	NA	Not an option	NA		2,215
B327	Radiography	NA	B	NA	2,041	NA		2,151
B381[7]	Office/Research	NA	B	NA	Not an option	NA		644

Table 5. (continued)

Facility No.	Name	Sector	Type	Partial Upgrade			Full Upgrade	
				A to B TEC(K$)	B to C TEC(K$)	A to C TEC(K$)	PC1 TEC(K$) Individual Sectors	PC1 TEC(K$) Entire Building
B391	Laser Bay and Support Labs	A	B	NA	917	NA	982	
	Laser Bay, Target Room, Optical Switch Yard	C	B	NA	Not an option	NA	739	
	Fan Loft	E	B	NA	406	NA	726	
	Laser/Optics	B391 All Sectors	B	---	---	---		2,338
B411	Shipping and Receiving	NA	A	NA	NA	NA		4,589
B431[8]	ETA II	NA	A	NA	Not an option	NA		819
B511	Maintenance/Crafts Shop	NA	A	712	NA	2,452		4,700
T2580	Communication Center	NA	B	No cost data available at this time.				
Total								50,114

[1] Based on June 2009 midpoint of construction, and reflects the mean estimate plus 30%.
[2] Except B115, B121, and T2580 that still require detailed evaluations, strengthening schemes, and TEC.
[3] Increments 1 and 3, 3-story portion.
[4] Bays 4 and 5.
[5] Bays 1 and 2.
[6] Only sector C of B166 does not pass life-safety (PC1).
[7] Only the high and low laboratory areas of B381 do not pass life-safety (PC1).
[8] Only the south wing of B431 does not pass life-safety (PC1). North wing has been demolished.

Table 6. Revised 10-year seismic mitigation plan for type A or B facilities.

Facility Number	Name	Type A or B	Full PC1 TEC(K$)[1]	Action	Date[2]
B231	Development and Assembly	A	18,301	Vacate	FY08–FY11
B431	ETA II	A	819	Vacate	FY08–FY10
B511	Maintenance/Crafts Shop	A	4,354	Vacate	FY09–FY10
B115	Computation Facility	B	Not Available	TBD	TBD
B121	PAT Office	B	Not Available	TBD	TBD
B141	Electronic Shops	B	Not Available	TBD	TBD
B166	Development Laboratory	B	146	Vacate	FY09–FY10
B321A	Materials Fab Shop	B	11,073	TBD	TBD
B327	Radiography	B	2,151	TBD	TBD
B381	Office/Research	B	644	TBD	FY11–FY13
B391	Laser/Optics	B	2,338	Retrofit	FY12–FY14
B411	Shipping and Receiving	B	4,589	Vacate	FY09–FY10
T2580	Communication Center	B	Not Available	TBD	TBD

[1] Assumes June 2009 as midpoint of construction and reflects the mean estimate plus 30%.
[2] Dependent on funding.

Table 7. DOE 1021 seismic performance categorization guidelines.

Performance Category	Guidelines of Preliminary Performance Categorization of Structures, Systems and Components (SSC)	Example Building Types
PC1[1]	• SSC is a building/structure with potential human occupancy. • SSC failure may cause fatality or serious injury to workers. • SSC failure can be prevented cost-effectively.	General use buildings such as administrative buildings, storage buildings, repair shops, etc.
PC2	• SSC performs emergency functions to preserve health and safety of workers. • SSC is part of building use to assemble $\geq$ 300 persons in one room. • SSC has been classified as safety-significant.[2] Has potential for on-site release. • Mission critical	Emergency operations centers, hospitals, fire stations and non-nuclear high, moderate or low hazard facilities depending on the safety significance.
PC3	• SSC failure has adverse release consequences greater than safety-class[2] SSC guidelines, but not severe enough to place it in PC4. Has potential for off-site release.	Buildings that contain significant amount of hazardous materials. Example – Cat 2 facility.
PC4	• SSC is a safety-class item and its failure would result in off-site release consequences greater than or equal to the unmitigated release associated with a large (200MW) Category A reactor severe accident.	Buildings that contain significant amounts of hazardous materials that have potential for major impact offsite. Example – Cat 1 facility.

[1] PC1 is DOE's life-safety standard.
[2] As defined in facilities Documented Safety Analysis.

Table 8. Seismic evaluation, rehabilitation, and design criteria for Laboratory facilities.

Performance Level	Existing Facility Evaluation	Existing Facility Rehabilitation	New Facility Design
PC1	ASCE 31-03 Life-Safety	ASCE-41-06 Life-Safety or IBC 2006 Use Group I	IBC 2006 Use Group I
PC2	ASCE 31-03 Immediate Occupancy	ASCE-41-06 Immediate Occupancy or IBC 2006 Use Group IV	IBC 2006 Use Group IV
PC3	DOE 1020-2002	DOE 1020-2002	DOE 1020-2002
PC4	DOE 1020-2002	DOE 1020-2002	DOE 1020-2002

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