

# Y-12

ES/CNPE-95/4

## OAK RIDGE Y-12 PLANT

LOCKHEED MARTIN 

### PHASE I - SCREENING GUIDELINES TO DETERMINE THE STRUCTURES EXEMPT FROM EXECUTIVE ORDER 12941

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September 1995

Prepared for the  
Center for Natural Phenomena Engineering  
Oak Ridge Y-12 Plant  
Oak Ridge, TN 37831-8169  
managed by  
Lockheed Martin Energy Systems, Inc.  
for the  
U. S. Department of Energy  
under contract DE-AC05-84OR21400

MANAGED BY  
LOCKHEED MARTIN ENERGY SYSTEMS, INC.  
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DEPARTMENT OF ENERGY

UCN-13672 (28 6-85)

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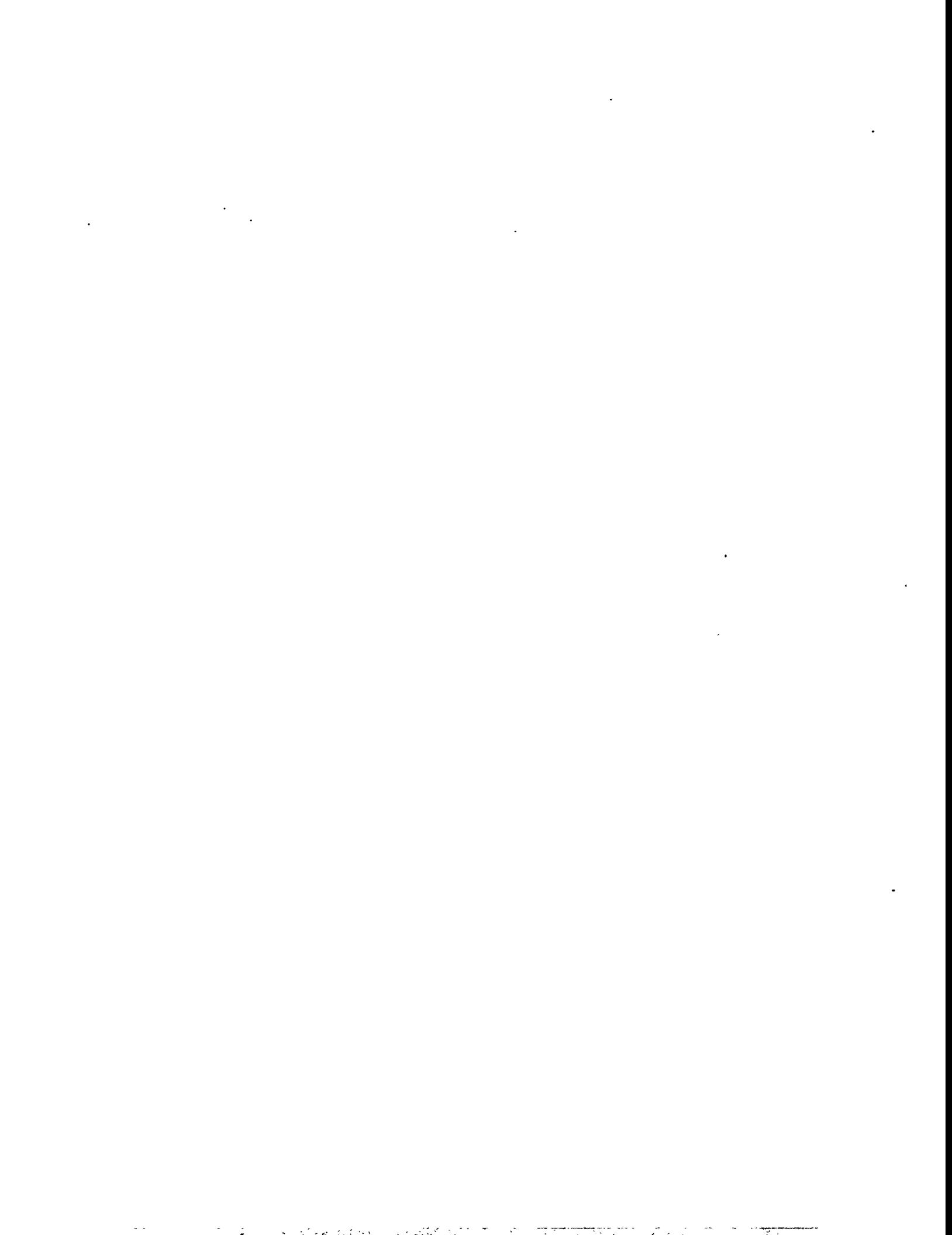
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**September 1995**

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## CONTENTS

ACRONYMS .....	v
LIST OF TABLES AND FIGURES .....	vii
1. INTRODUCTION .....	1
1.1 BACKGROUND .....	1
1.2 PURPOSE AND SCOPE .....	1
2. DEFINITIONS .....	2
2.1 STANDARDS .....	2
2.2 BUILDINGS .....	2
2.3 NON-BUILDINGS .....	2
2.4 PRIVATELY OWNED .....	2
2.5 ESSENTIAL BUILDINGS .....	2
2.6 HAZARDS .....	3
3. SCREENING CRITERIA .....	3
3.1 GENERAL .....	3
3.2 FACILITIES INFORMATION MANAGEMENT SYSTEM .....	4
3.3 GROUPING OF INVENTORY .....	4
3.3.1 General .....	4
3.3.2 Owned .....	5
3.3.3 Leased .....	5
3.4 EXEMPTION CRITERIA .....	5
3.4.1 Criteria .....	5
3.4.2 Assumptions .....	7
3.4.3 Candidates for Exemption .....	7
3.5 VISUAL VERIFICATION .....	10
3.5.1 Inspection Requirements .....	10
3.6 REQUIRED INVENTORY DATA FOR OWNED, EXEMPT BUILDINGS .....	10
4. QUALIFICATIONS OF EVALUATORS .....	11
5. REFERENCES .....	11

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## ACRONYMS

DOE	Department of Energy
EO	Executive Order
FEMA	Federal Emergency Management Agency
FIMS	Facilities Information Management System
GSA	General Services Administration
HVAC	Heating, Ventilation and Air Conditioning
ICSSC	Interagency Committee on Safety in Seismic Construction
LMES	Lockheed Martin Energy Systems, Inc.
NEHRP	National Earthquake Hazards Reduction Program
NPH	Natural Phenomena Hazard
ORNL	Oak Ridge National Laboratory
PC	Performance Category
PGDP	Paducah Gaseous Diffusion Plant
PORTS	Portsmouth Gaseous Diffusion Plant
RP	Recommended Practice
RPIS	Real Properties Inventory System (U. S. Department of Energy)

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## **LIST OF TABLES AND FIGURES**

Table 1.	Advisory Benchmark Years .....	6
Table A.	Required Inventory Data for Exempt Buildings .....	10
Figure 1.	Flow Chart of Screening Activities .....	9

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## 1. INTRODUCTION

### 1.1 BACKGROUND

Congress enacted the "Earthquake Hazards Reduction Act of 1977" (Public Law 95-124, as amended) to reduce risks to life and property from future earthquakes in the United States. This law set into motion the establishment and maintenance of an effective earthquake hazard reduction program, which led to the creation of the National Earthquake Hazards Reduction Program (NEHRP). Since then the Interagency Committee on Seismic Safety in Construction (ICSSC) prepared Executive Order (EO) 12699, "Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction", and EO 12941, "Seismic Safety of Existing Federally Owned or Leased Buildings". President Bush signed EO 12699 on January 5, 1990, and President Clinton signed EO 12941 on December 1, 1994.

From January 5, 1990, all newly constructed federal buildings and additions to existing federal buildings should conform to EO 12699 and, therefore, should satisfy EO 12941. Section 1 of EO 12941, "Seismic Safety of Federally Owned or Leased Buildings", states, in part, *Evaluations and mitigations that were completed prior to the date of this order under agency programs that were based on standards deemed adequate and appropriate by the individual agency need not be reconsidered unless otherwise stipulated by the Standards (the Standards (ICSSC RP 4/NISTIR 5382, 1994) are developed, issued, and maintained by ICSSC)*. Section 2 states, in part, *Each agency that owns or leases buildings for Federal use shall, within 4 years of the issuance of this order, develop and inventory of their owned or leased buildings and shall estimate the cost of mitigating unacceptable seismic risk in those buildings. The cost estimates will be based on the exemptions and evaluations and mitigation requirements in the Standards.*

The ICSSC is currently balloting a draft version of ICSSC RP 5 (July 3, 1995), " ICSSC Guidance to Implementing EO 12941 on Seismic Safety of Existing Federal Buildings". The ICSSC is also preparing a ballot version of ICSSC RP 6 (August 4, 1995), "ICSSC Guidance: Implementing EO 12941 HANDBOOK".

On January 15, 1993 the U. S. Department of Energy (DOE) issued Order DOE 5480.28, "Natural Phenomena Hazards Mitigation". The purpose of this order is to establish the DOE policy and requirements for natural phenomena hazard (NPH) mitigation for the DOE sites and facilities using a graded approach. The graded approach consists of five Performance Categories PC-0 through PC-4 each having a defined performance goal. Aside from earthquake hazards, the order also applies to tornado/high winds and floods.

In response to Order 5480.28, Lockheed Martin Energy Systems, Inc. (LMES) operating contractor, has issued "Draft Implementation Plan for Department of Energy Order 5480.28, Natural Phenomena Hazards Mitigation". A part of this plan is to develop screening guidance of structures to be exempted from EO 12941.

### 1.2 PURPOSE AND SCOPE

The purpose of this document is to provide the screening guidance for identifying structures exempted from EO 12941 by collecting only the minimum information needed. The information needed will vary from building to building and from site to site.

The scope of the guidelines is to cover all five DOE sites that fall under the DOE Oak Ridge Operations and are operated by LMES. These facilities are the Oak Ridge National Laboratory (ORNL), the Oak Ridge Y-12 Plant, and the Oak Ridge K-25 Site all at Oak Ridge, Tennessee; the Paducah Gaseous Diffusion Plant (PGDP),

Paducah, Kentucky; and the Portsmouth Gaseous Diffusion Plant (PORTS), Portsmouth, Ohio. Off site facilities, owned or leased, that are occupied by LMES are also included.

The Standards require at least two data bases, owned and leased, be created. For each DOE site there will be four "Exempt" data bases created:

1. Plant Site/Privately Owned,
2. Plant Site/Owner,
3. Off Site/Leased; and
4. Off Site/Owned.

Many other data bases will be created in the process of creating the "Exempt" data bases and they should be saved to facilitate future evaluations of the "Non-Exempt" buildings as required by EO 12941 and the Standards.

It is not the intent of this guideline to perform analyses or perform screening as required by the Standards in Chapter 3.0 Evaluations.

## **2. DEFINITIONS**

### **2.1 STANDARDS**

Standards of Seismic Safety for Existing Federally Owned or Leased Buildings, ICSSC PR 4, February 1994.

### **2.2 BUILDINGS**

For the purpose of EO 12941, a building is defined as any structure, fully or partially enclosed, located within the United States as defined in the Earthquake Hazards Reduction Act of 1977, as amended [42 U.S.C. 7703(5)], used or intended for sheltering persons or property, except for Non-Buildings.

### **2.3 NON-BUILDINGS**

Non-Buildings are special structures that are specified in the Standards which include, but are not limited to : bridges, transmission towers, industrial towers and equipment, piers and wharves, and hydraulic structures.

### **2.4 PRIVATELY OWNED**

A Privately Owned buildings is defined as any Federally permitted or regulated, privately owned building on Federal land. A church building could be an example of a Federally permitted, privately owned building.

### **2.5 ESSENTIAL BUILDINGS**

Essential buildings are defined in the Standards as those which, in the judgement of the owning agency, require a level of seismic resistance that is higher than life safety. (Life safety is the minimum level of protection required by the Standards. After an earthquake, a "life safety" building should not have caused any fatalities, but it may be so badly damaged that it is no longer functional or even salvageable.) Examples of buildings which may fall into the Essential category are:

- hospitals, fire and police stations, communication and command centers and other buildings that must remain functional in order to respond to an earthquake emergency;

- buildings which must remain operational after an earthquake to maintain critical agency functions;
- buildings housing hazardous materials which, if released, would create additional threats after an earthquake, and;
- buildings housing vulnerable populations or extremely valuable contents.

Some examples of an essential building could be buildings that house the Emergency Operations Center (EOC), the Plant Shift Superintendent's Office, Fire Stations, Emergency Response Center, Vital Plant Record, etc.

## 2.6 HAZARDS

A hazard is a source of danger with potential to cause illness, injury or death to persons, or damage to a facility or to the environment.

Significant seismic hazards are defined in the Standards in terms of four compliance categories which are:

Structural hazards:	Structural elements of a building's vertical and lateral load carrying system that could be damaged or fail during an earthquake.
Non-structural:	Components of a building that do not contribute to the gravity or lateral-load carrying capacity (strength) of the building such as tall, unreinforced, non-infilled, hollow clay tile, masonry partition walls, parapets, exterior cladding or cornices; a collection of components such as piping, cable trays, conduits, or heating, ventilation and air conditioning (HVAC); and an item of equipment such as a pump, valve, relay, or and element of a larger array such as a length of pipe, elbow, or reducer are considered as non-structural components.
Geologic/site:	Earthquake related hazards at a building site which occur during or after the earthquake. Includes surface faulting, landslides, liquefaction, and flooding due to tsunamis.
Adjacency:	Hazards caused when adjacent buildings or special structures as defined in Section 3.4.1 interact during an earthquake. Includes pounding, effects of one building buttressing another, falling hazards from an adjacent building, and the consequences of damage to common structural elements such as party walls (single bearing walls supporting two adjacent buildings constructed on separately defined parcels of land).

## 3. SCREENING CRITERIA

### 3.1 GENERAL

The screening process relies heavily on the Facilities Information Management Systems (FIMS) which replaced the Real Properties Inventory System (RPIS). FIMS is to be compared with Plant Building Directories to ensure all buildings are identified. The most recent data is to be used in the screening process. The screening criteria require that four data bases of exempt buildings be created for each plant site. The data bases will include only

those buildings that are owned or leased by the DOE and are operated or occupied by LMES. The methodology for creating the data bases is given in Section 3.4.

### **3.2 FACILITIES INFORMATION MANAGEMENT SYSTEM**

The Office of Field Management of the DOE manages the real property of the department. Real property includes land and its natural resources, and any man-made alterations and additions -- buildings, permanent fixtures, and equipment. This information is used for reporting the size and cost of those holdings to the General Services Administration (GSA) and other external inquiries. FIMS was developed by DOE to support one consolidated corporate database. FIMS is a Windows-based application developed using Powersoft's Power Builder, Version 3.0a and Microsoft's Access V1.1. The database engine is Oracle V7.0 running on a HP UNIX machine. FIMS, now the primary system for facility management information at the DOE, incorporates the following:

- graphical User Interface to facilitate data entry and inquiry;
- context sensitive on-line help;
- computer based tutorial of FIMS application basics;
- standard report facility;
- ad hoc analysis and reporting; and
- batch upload capability to support information transfer from non-FIMS databases.

As the "corporate" database for the DOE, FIMS is built to provide users with easy access to up-to-date real property information. FIMS will be:

- accessible to the DOE employees and contractors requiring facilities information;
- a core database of facility information which can be linked to related databases currently used by DOE as well as future databases; and
- a single point of entry, whenever possible.

FIMS contains the information necessary to respond to external inquiries such as the mandatory GSA Report and the DOE Yearly Statistical Handbook. All information in FIMS is unclassified and is subject to disclosure under the Freedom of Information Act.

### **3.3 GROUPING OF INVENTORY**

#### **3.3.1 General**

The Standards require that different actions be taken depending on whether an agency owns or leases a building; therefore, before any decision can be made concerning the disposition of buildings they should be grouped into owned or leased data bases.

### **3.3.2    Owned**

The database of owned buildings must be screened in accordance with the exemption criteria presented in Section 3.4.

### **3.3.3    Leased**

The Standards state that non-federally owned buildings and portions of such buildings leased by the Federal Government are exempt from the Standards if both of the following apply:

- the leased space is less than 930 m<sup>2</sup> (10,000 square feed), and
- the Federal Government leases less than 50 percent of the total building square footage.

The remaining leased buildings cannot be exempted from the Standards; however, additional criteria that apply to them are covered in the Standards but are beyond the scope of this guideline. For example, the Standards state, "No new leases or lease renewals shall be made in buildings that do not comply with the Standards". The determination of the disposition of leased buildings that are not exempt will be made at a later date.

## **3.4    EXEMPTION CRITERIA**

### **3.4.1    Criteria**

The exemption criteria is defined in the Standards on Page 3, Section 1.3. This entire Section is reproduced below and forms the reference point for the screening criteria for the DOE Oak Ridge Operations sites contained in this guide. Several items in Section 1.3 do not apply to the DOE sites. The reasons they do not are covered in Section 3.4.2, "Assumptions".

#### **1.3    Scope-Buildings**

*Except for buildings which require a seismic performance objective beyond Substantial Life-Safety because of agency mission requirements, the following buildings are exempt from these Standard:*

- a.    buildings classified for agricultural use, or intended only for the incidental human occupancy, or occupied by persons for a total of less than 2 hours a day,*
- b.    detached one- and two- family dwellings that were located in areas having a governing acceleration coefficient less than 0.15 (within the United States, where A<sub>v</sub> is less than 0.15 as delineated on Map 4 of the 1991 NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings),*
- c.    special structures including, but not limited to: bridges, transmission towers, industrial towers and equipment, piers and wharves, and hydraulic structures,*
- d.    one-story buildings of steel light frame or wood construction with areas less than 280 m<sup>2</sup> (3000 square feet)*
- e.    fully-rehabilitated buildings which comply with these Standards in all four compliance categories (structural, nonstructural, geologic/site hazards, and adjacency),*
- f.    post-benchmark buildings as defined in Table 1 which also comply with the nonstructural, geologic/site, and adjacency compliance categories,*

- g. *pre-benchmark buildings which have been shown by evaluation to be life-safe in all four compliance categories,*
- h. *buildings constructed for the Federal Government whose detailed design was done after the date of the adoption of Executive Order 12699 (January 5, 1990) and that were designed and constructed in accordance with the ICSSC Guidelines and Procedures for Implementation of the Executive Order on Seismic Safety of New Building Construction,*
- I. *leased buildings identified in Section 1.3.2 as exempt, or*
- j. *federally permitted or regulated privately owned buildings on Federal land.*

### 1.3.1 Post-benchmark Buildings

*A post-benchmark building is one that was designed and built after the adoption of seismic code provisions which are generally considered to provide acceptable life-safety protection. The determination of benchmark years is complex and varies with building location, age, structural system, and governing building code. An advisory table of benchmark years is provided in Table 1. Based on each agency's mission, facility locations, and construction history, each agency should develop benchmark years for its own use.*

*Table 1. Advisory Benchmark Years*

		<i>Model Building Seismic Design Provisions</i>				
<i>FEMA 178<sup>1</sup></i>	<i>BUILDING TYPE</i>	<i>BOCA</i>	<i>SBCC</i>	<i>UBC</i>	<i>ANSI</i>	<i>NEHRP</i>
1,2	<i>Wood Frame, Wood Shear Panels</i>	**	**	<b>1949</b>	**	**
3	<i>Steel Moment Resisting Frame (MRF)</i>	<b>1987</b>	<b>1991</b>	<b>1976</b>	<b>1882</b>	<b>1985</b>
4	<i>Steel Braced Frame</i>	<b>1990</b>	<b>1991</b>	<b>1988</b>	*	<b>1991</b>
5	<i>Light Metal Frame</i>	*	*	*	*	*
6	<i>Steel Frame w/ Concrete Shear Walls</i>	<b>1987</b>	<b>1991</b>	<b>1976</b>	<b>1982</b>	<b>1985</b>
8	<i>Reinf. Conc. Moment Resisting Frame</i>	<b>1987</b>	<b>1991</b>	<b>1976</b>	<b>1982</b>	<b>1985</b>
9	<i>Reinf. Concrete Shear Walls w/o MRF</i>	<b>1987</b>	<b>1991</b>	<b>1976</b>	<b>1982</b>	<b>1985</b>
10,7	<i>Steel or Concrete Frame w/ URM Infill</i>	*	*	*	*	*
11	<i>Tilt-up Concrete</i>	<b>1987</b>	<b>1991</b>	<b>1973</b>	<b>1982</b>	<b>1985</b>
12	<i>Precast Concrete Frame</i>	*	*	*	*	*
13,14	<i>Reinforced Masonry</i>	<b>1987</b>	<b>1991</b>	<b>1976</b>	<b>1982</b>	<b>1985</b>
15	<i>Unreinforced Masonry (URM)</i>	*	*	*	*	*

<sup>1</sup> The tabulated numbers refer to the 15 common building types as they are defined in FEMA 178

\* Indicates no benchmark year (no comprehensive seismic requirements for these buildings exist).

\*\* Local provisions for wood construction need to be compared to 1949 UBC to determine benchmark year

*BOCA - Building Officials and Code Administrators, National Building Code. (BOCA adopted the NEHRP 1991 seismic provisions in a 1992 Addendum to their 1990 edition.)*

*SBCC - Southern Building Code Congress, Standard Building Code. (SBCC adopted the NEHRP 1991 seismic provisions in a 1992 Addendum to their 1991 edition.)*

*UBC - International Conference of Building Officials, Uniform Building Code.*

*ANSI - American National Standards Institute, A58.1, Minimum Design Loads for Buildings and Other Structures.*

*NEHRP - Federal Emergency Management Agency, NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings.*

### **3.4.2 Assumptions**

There are ten building types to be exempted, "a" through "j", as defined in Section 1.3 of the Standards (repeated in Section 3.4.1 of this document) which must be considered.

Types "a" and "d" form the largest number of buildings that are candidates for exemption and, thus, will form the largest "Exempt" data base.

Building Type "b" does apply; however, there are no known detached one- and two-family dwellings owned by the DOE.

Building Type "c", special structures, are exempt and are not to be included in the data base.

Types "e", "f", and "g" do not apply. The main reason for this is the lack of proof that these building types comply with the four performance categories (structural, non-structural, geologic/site hazards, and adjacency) as defined in Section 2.5. Since Type "f", (post-benchmark buildings), do not apply the entire Section 1.3.1 in the standards, which discusses post-benchmark buildings, may be ignored.

Buildings in Type "h", (buildings constructed for the Federal Government whose detailed design was done after the date of the adoption of EO 12699 (January 5, 1990) and that were designed and constructed in accordance with the ICSSC *Guidelines and Procedures for Implementation of the Executive Order on Seismic Safety of New Building Construction*), may be exempt if it can be shown by design documentation that they are life-safe in all four (4) performance categories.

Leased buildings, Type "I", are exempt if they meet the requirements of Section 3.3.3.

Type "j" buildings are exempt without exception.

### **3.4.3 Candidates for Exemption**

Multiple data bases at each of the five DOE sites will be created for the buildings. The methodology for creating the exempt data bases is depicted in Figure 1, Flowchart of Screening Activities. The flowchart depicts a process that is typical for each of the five DOE sites as listed in Section 1.2. The first data base to be created for each site will be an up-to-date listing of all real property. This can probably be accomplished by comparing FIMS with the Plant Building Directory for the site.

Once all real properties have been identified, two data bases, Plant Site and an Off Site, will be made. These two data bases will be handled separately where each branch of the flowchart will end in terminuses designated by either "Exempt" or "Exempt Candidate" data bases. Two of the Exempt data bases will be further treated as indicated by the instruction in the box marked by the number 1 in a circle. A detailed explanation of these instructions is given below in Section 3.6. Each Exempt Candidate data base will be further screened by the requirements shown in the flowchart. The Plant Site data base will be divided further into Owned and Privately Owned data bases. The Privately Owned data base is exempt by the Standards and thus will form the first part of the final data base of exempt buildings. The Owned data base will be divided to screen out the "not LMES Operated buildings", which are out of the scope of LMES responsible. The next step is to screen out the Non-Buildings from the DOE Owned/LMES Operated data base.

The Off Site data base is to be separated into an Owned and a Leased data base as required by the Standards. Next the Leased data base should be screened to contain only the LMES Operated buildings. According to the Standards, a leased building is exempt if it contains less than 930 m<sup>2</sup> (10,000 square feet) and less than 50% of the floor space is leased. If both of these conditions are met for a LMES Operated/Leased Building, the building is to be placed into a data base of Non-exempt leased buildings. Next the Off Site-Owned data base should be screened to contain only the LMES Operated structures, which is then screened to remove the Non-Buildings to form the Off Site/Owned/LMES Occupied data base. From this point both the Plant Site and Off Site data bases are treated the same; therefore, the type of data base will not be mentioned in the following description.

The next step is to identify all buildings built after January 1, 1990, the date EO 12699 went into effect. The supporting design documentation should be checked for this group of buildings to determine if any of them comply with the four hazard categories as defined above. If the answer is yes, they should be placed into an "Exempt Candidate" data base for further screening.

At this point in the screening process two "Exempt" data bases, Plant Site/Privately Owned and Off Site/Leased, and two partially completed "Exempt Candidate" data bases, Plant/Site Owned and Off Site/Owned, will have been created (data bases other than "Exempt" or "Exempt Candidate" that have been created but are not a part of this task should be saved for future use). The buildings that have not already been screened out or placed into one of the two "Exempt" data bases are to be categorized according to the 15 common building Types "1" through "15" as defined in the Standards and listed in Section 3.4.1 above. Those buildings that have not already been selected as a candidate for exemption, "Exempt Candidate", are to be screened according to the requirement for building Type "a", "b", "d" or "h" in the Standards (summarized in Section 3.4.1 above). The buildings that meet one or more of the requirements are to be placed into the "Exempt Candidate" data base, as appropriate. At this point there should now be two data bases of "Exempt" and two data bases of "Exempt Candidate" for each DOE site. The "Exempt Candidate" data bases are to be visually inspected for final confirmation of their exempt status as described below.

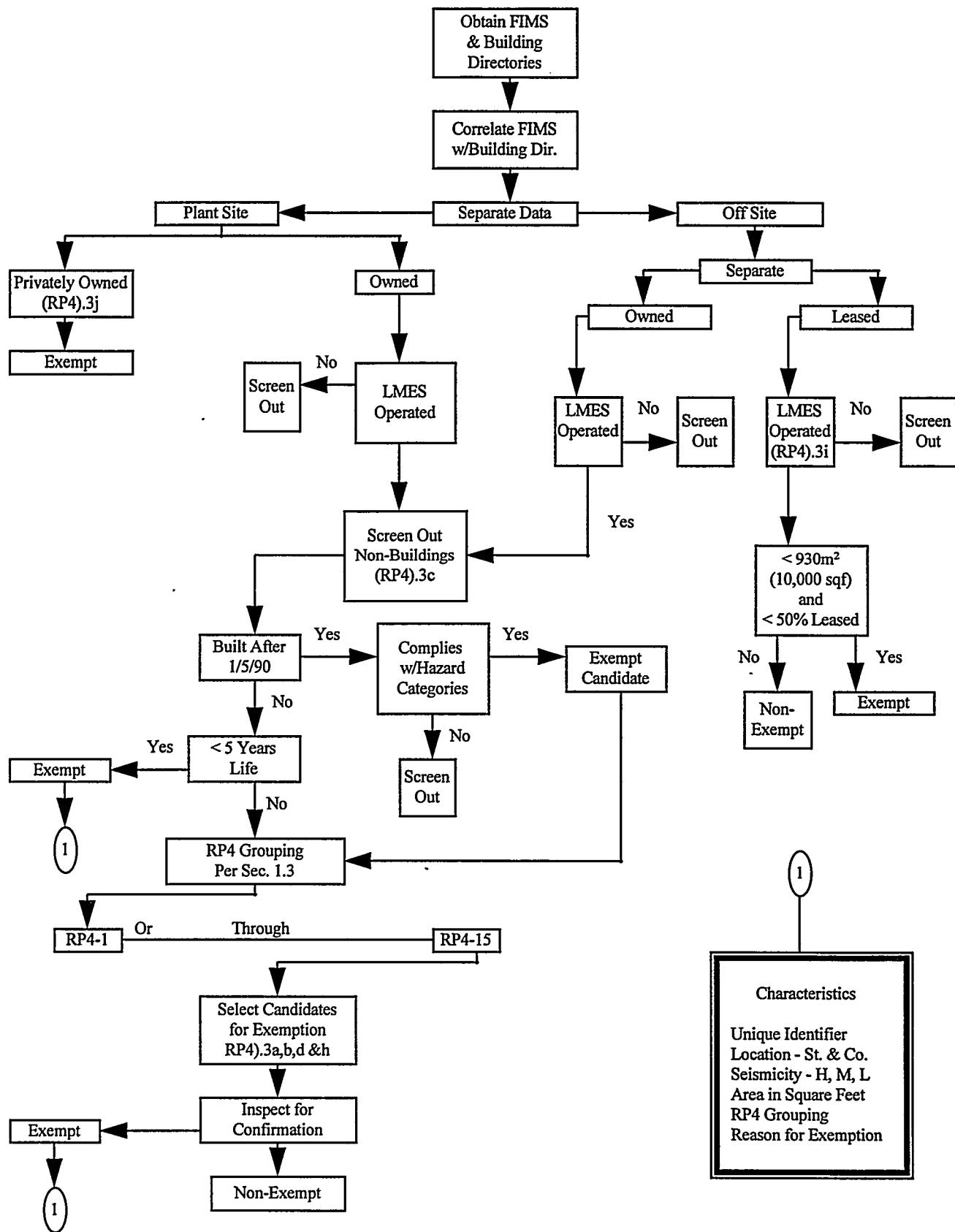


Figure 1. Flowchart of Screening Activities

### 3.5 VISUAL VERIFICATION

#### 3.5.1 Inspection Requirements

Buildings in both "Exempt Candidate" data bases must be inspected to confirm their exempt status. This inspection should be a quick site visit to determine if the building still exists and if there have been any modifications not contained in the FIMS data or Building Directory. If a building exists and has not been modified it can now be placed into either the Plant Site/Owned or Off Site/Owned data base as appropriate. If a building no longer exists, this fact should be reported to the Office of Field Management of the DOE which is the organization responsible for real properties inventories. If a building has been modified it must be checked against the requirements of Building Type "a" and "d" as before. If it meets these two requirements it also can be placed into either the Plant Site/Owned or Off Site/Owned data base as appropriate.

### 3.6 REQUIRED INVENTORY DATA FOR OWNED, EXEMPT BUILDINGS

The final step in the process is to fill in Table A, the contents are suggested by the draft version of ICSSC RP 5 (1995). Table A completes the requirements indicated by the number 1 enclosed in the circle on the flowchart. Besides the Exempt Category, Table A in RP 5 covers Non-Exempt, Not Evaluated and Non-Exempt, Evaluated Categories. Because this guideline is limited to the Exempt Category, Table A has been modified to include only the applicable Characteristics.

**Table A. Required Inventory Data for Exempt Buildings**

Characteristic
Unique Identifier
Location-State & County
Seismicity-High, Moderate, Low
Area in Square Feet
ICSSC RP 4 Building Type 1-15
Reason for Exemption

Terms used in Table A which require definition are as follows:

**Unique Identifier** is whatever alpha-numeric FIMS uses to identify real property/

**Seismicity** levels are defined by the Map Areas given on Map 2 (A<sub>v</sub>, county-by-county) in the 1994 *NEHRP Recommended Provisions* [BSSC, 1994].

Low seismicity: Map Areas 1 and 2

*This includes all of the Portsmouth Gaseous Diffusion Plant, Portsmouth, Ohio*

Moderate seismicity: Map Areas 3 and 4

*This includes all three sites located in Oak Ridge, TN; the Oak Ridge National Laboratory, the Oak Ridge Y-12 Plant, and the Oak Ridge K-25 Site. It also includes all of the Paducah Gaseous Diffusion Plant, Paducah, KY.*

#### **4. QUALIFICATION OF EVALUATORS**

All evaluations shall be prepared by a degreed civil/structural engineer qualified to perform the work by registration and/or experience. Decision as to whether a building complies with the four (4) hazard categories, structural, nonstructural, geologic/site, and adjacency and the type of building "a" through "h" should be made by a degreed engineer qualified in the field of earthquake engineering.

#### **5. REFERENCES**

1. Draft 1 ICSSC RP 5. 1995. *ICSSC Guidance on Implementing EQ 12941 on Seismic Safety of Existing Federal Buildings.*
2. Draft 1 ICSSC RP 6. 1995. *ICSSC Guidance: Implementing EO 12941 HANDBOOK*
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