TRENDS IN LONG-TERM CARE

HEARINGS

BEFORE THE

SUBCOMMITTEE ON LONG-TERM CARE

OF THE

SPECIAL COMMITTEE ON AGING

UNITED STATES SENATE

NINETY-SECOND CONGRESS

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[1] Senator Winston Prouty, Vermont, served as ranking minority member of the committee from September 1969, until his death, September 10, 1971. Senator Robert T. Stafford, Vermont, was appointed to fill the vacancy on September 17, 1971.

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TRENDS IN LONG-TERM CARE

(Lil-Haven Nursing Home, Salt Lake City, Utah)

WEDNESDAY, SEPTEMBER 29, 1971

U.S. SENATE,
SUBCOMMITTEE ON LONG-TERM CARE
OF THE SPECIAL COMMITTEE ON AGING,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 3110, New Senate Office Building, Senator Frank E. Moss (chairman) presiding.

Present: Senators Moss and Stafford.

Staff members present: Val Halamandaris, professional staff member; John Guy Miller, minority staff director; and Phyllis Balan, clerk.

OPENING STATEMENT BY SENATOR FRANK E. MOSS, CHAIRMAN

Senator Moss. The subcommittee will come to order.

We welcome you this morning to the Subcommittee on Long-Term Care as we meet to study the Federal implications of the September 15 Lil-Haven Nursing Home fire in Salt Lake City which resulted in the death of six people and the injury of 11 more of the home's 18 patients.

This subcommittee has investigated several nursing home fires; our hearings have led to new legislation and greater protection against fires for our infirm elderly.

After investigating the Fitchville, Ohio, fire and the Fountaintown, Ind. fire, I introduced legislation requiring Medicaid nursing homes to comply with the Life Safety Code (21st edition) of the National Fire Protection Association.

After the Marietta, Ohio, fire I was chagrined to learn that Medicare had virtually no fire standards at all and insisted that the Life Safety Code be made applicable to Medicare, extended-care nursing homes. This was accomplished in principle by the operation of a comparability, section (1861) of the Medicare law. However, some 20 months have elapsed since the Marietta, Ohio, fire, and the Bureau of Health Insurance has yet to issue regulations so that the States will know how to apply the Life Safety Code to their Medicare nursing homes.

After the Marietta fire we began to give some attention to furnishings installed in nursing homes. It makes very little sense to insist on fire-resistant structures and then to fill them with extremely flammable furnishings, such as carpets, curtains, plastic wastepaper baskets, and the like.

The carpeting installed in institutions became of particular concern to us during our investigations because it was named by the State of Ohio fire officials as the primary cause of death for the 31 who died in the Marietta fire. In spite of all our efforts, the only protection provided to the infirm and the general public alike at the present time is the so-called "pill test" for flammability. This test eliminates very little carpet from the market and gives nursing home patients less than minimal protection.

I recognize that the National Bureau of Standards is looking forward to the promulgation of second-generation tests for flammability and smoke emission such as are presently provided by the current American Society of Testing and Materials E–84 Tunnel test. For my part, these protections are long overdue.

Today we meet to document for the Federal record the events of the Lil-Haven Nursing Home fire which occurred in my own hometown of Salt Lake City, Utah. It is our hope to learn from this fire and prevent similar occurrences. I had an opportunity to visit the scene of the fire, and I must admit I was a little discouraged. Newspaper accounts indicate that the automatic alarm system worked well, notifying the fire department; and that the fire department arrived at the scene very swiftly, and yet significant losses of life, injuries, and damage resulted.

I was discouraged to learn that the Lil-Haven Nursing Home is a new category of federally assisted nursing homes called an intermediate care facility, which is funded under title XVI of the Social Security Act, and, as such, it is exempt from the provision of my amendment requiring that nursing homes comply with the Life Safety Code.

What this means is that there are no Federal minimum fire safety standards for the intermediate care nursing homes. This is the only category of nursing facilities paid for in part by Federal funds which do not have comprehensive fire standards. This situation is intolerable, and I have announced my intention to introduce legislation making the Life Safety Code of the National Fire Protection Association applicable to intermediate care facilities.

I have, today, sent a letter to Elliot Richardson, Secretary of the Department of Health, Education, and Welfare, calling attention to the fact that there is no systematic investigation made of fires that occur in nursing homes that are under the jurisdiction of his Department and funded, at least in part, with Federal funds. For this reason, this committee has had to make its own investigations. We feel this is a little backward and that the Department should investigate and then report to us.

I am going to put this letter in the record and I would, at this point, read just two short paragraphs from it. I said:

> Accordingly, I am asking today that the Department of HEW establish within their Public Health Service an investigatory unit which would have the responsibility of documenting the events of any fire occurring in a facility supported in part of Federal funds. This investigatory unit would be required to return to the Congress a full report of the fire at the earliest possible opportunity.

And later I say:

> And at the same time I intend to introduce legislation to create a National Fire Testing Center at the University of Utah which already has an excellent flammability research center having completed many excellent studies on behalf of the Defense Department, NASA, Federal Aviation Agency, and others.

(The letter follows:)

U.S. SENATE,
SPECIAL COMMITTEE ON AGING,
Washington, D.C., September 29, 1971.

HON. ELLIOT RICHARDSON,
Secretary of Health, Education, and Welfare.

DEAR MR. SECRETARY: It has commonly been stated that more than 2.5 million fires occurred in the United States during 1969 and the estimated value of these losses has been placed at over $2 billion.

As you know, Mr. Secretary, the elderly constitute some 10 percent of the population but 25 percent of the deaths by fire. Most of these deaths could be attributed to institutional and especially nursing home fires.

The National Fire Protection Association, in fact, has stated that their documented record of death and injuries in these institutions places nursing homes in the unenviable position of number one on the list of unsafe places to live.

My Subcommittee on Long-Term Care of the U.S. Senate Committee on Aging has investigated a great number of these fires. We have gathered facts and constructed a Federal Record of the events of several fires and on the basis of this evidence we have suggested new legislation and remedial administrative action by Government agencies.

As I toured the most recent nursing home fire which broke out in my own home town of Salt Lake City I was struck by the thought that the Department of Health, Education and Welfare is vested with primary authority for Federal assisted nursing programs and that your Department, specifically the Public Health Service, has a great reservoir of Fire Safety expertise.

Accordingly, I am asking today that the Department of HEW establish within their Public Health Service an investigatory unit which would have the responsibility of documenting the events of any fire occurring in a facility supported in part by Federal funds. This investigatory unit would be required to return to the Congress a full report of the fire at the earliest possible opportunity.

Would you comment on the above suggestion? If such a subdivision cannot be established within the Public Health Service by administrative action then I would intend to introduce legislation to this effect forthwith.

At the same time I intend to introduce legislation to create a National Fire Testing Center at the University of Utah which already has an excellent Flammability Research Center having completed many excellent studies on behalf of the Defense Department, NASA and FAA.

Sincerely,

FRANK E. MOSS,
Chairman, Subcommittee on Long-Term Care.

Senator Moss. We, in fact, will have a witness this morning from the University of Utah who is an expert on this question of flammability and he will point out that we yet don't know much about fires and what causes injury and death.

We have several witnesses to hear this morning, and I therefore will not prolong my remarks. The witnesses have come from Utah, and I do appreciate their traveling this long distance to be able to appear before this subcommittee and help us to make this record, and to learn what we can from this tragic fire that occurred in Salt Lake City.

Our first witnesses will be Mr. Robert A. Tanner, Utah State Fire Marshal; and Mr. Ben Andrus, Salt Lake City Fire Marshal. We welcome you, gentlemen, here before us, and you may proceed. We will hear first from Mr. Tanner and then Mr. Andrus.

STATEMENT OF ROBERT A. TANNER, UTAH STATE FIRE MARSHAL

Mr. TANNER. Thank you, Senator Moss.

My name is Robert A. Tanner and I joined the Salt Lake City Fire Department in 1935. At that time they did not have a fire prevention bureau. This was organized in 1940 and at that time I was assigned

to this division. During my 10 years in the Fire Prevention Bureau I have seen these so-called nursing homes as we call them now. At that time they were board and room or lodging; and not lodging, I think, as we think back in the days of the lumberjacks or the miners, where they worked all day and came home to food and a bed at night, but this was our elderly people; they were starting to get shipped out into these old homes that no longer had a retail value near their original worth.

Consequently, these homes were picked up and Salt Lake City had many of them, two- and three-story homes no longer suitable as a one-family dwelling. They were picked up generally by a couple who would take in four or five roomers and provide room and board and, generally, to the elderly.

Our first approach to this problem was exits. Of course at that time we tried to get an exit out of every room. Consequently, in many of the old homes in Salt Lake City you will see fire escapes from all four sides of the building. This we know now was not the right approach.

Regulations—Cost Factor

In 1963 the Salt Lake City Commission adopted regulations on nursing homes. It held several public hearings and, of course, always the matter of cost entered into the picture. So we did not at that time get the regulations we would have liked. We had to accept regulations that we felt were inferior. Nevertheless, they were a step.

In 1964 the first Fire Marshal Act was passed and the State of Utah had a Fire Marshal Bureau. I was assigned to that office and the State Fire Prevention Board immediately convened and drew up regulations on nursing homes. Here again we ran into the same problem, cost. We would have liked to have accepted the Life Safety Code at that time, but it was impossible from the standpoint of finance.

We did do this much. We said that all nursing homes that did not have the services of a nonduty paid fire department would be required to sprinkler. We have only four cities that have paid fire departments in the State of Utah. So of the 136 nursing homes in the State, some 41 were required to sprinkler the homes immediately.

I think that over the years we have made a lot of progress. Many of the old family-type homes of two and three stories have been abandoned. We have many new beautiful structures. In my opinion, there is no substitute for automatic sprinklers, and I think the Fire Marshals Association of North America went on record to this effect some 10 years ago.

It has been our opinion that this is the only way to provide complete protection, and we have some instances. I realize, where we have lost lives even with sprinklers, but it is the only answer to a multiple loss of lives. Before going farther, and I would like to later point out just the steps Utah is taking at this time to correct the situation, I think perhaps we should have an understanding of what happened at the Lil-Haven Nursing Home in Salt Lake City. So at this time, Senator, if I may, I would like Marshal Andrus to show these slides and this will give us an idea of what we are talking about.

Senator Moss. We will be glad to do it that way.

Lil-Haven did not have a sprinkler system in it?

Mr. TANNER. It did not. It had a detection system going directly to the fire department. When the alarm went off in the Lil-Haven Nursing Home it went off at the same time in the fire office in Salt Lake City. Response time was tremendous; they got there in just about a minute and they had ample manpower and equipment, which, in my opinion, points to the fact that detection alone is not enough.

Senator Moss. I see.

We would be glad to have you proceed with your slides, Marshal Andrus, and whatever comments you have to make with them.

STATEMENT OF BEN ANDRUS, SALT LAKE CITY FIRE MARSHAL

Mr. ANDRUS. Thank you, Senator.

Before I go into the slides I would like to run the times on this fire. Our district chief in this area was coming back from another alarm at approximately eight-tenths of a mile away from the Lil-Haven when the warning on the dispatch came in. This dispatch took 50 seconds from the time they made the preliminary warning until they completed, and gave the time as 0041 or 12:41 a.m. The district chief arrived at 0042, or 58 seconds from the conclusion of the preliminary warning. The first engine company arrived at 0043, 1 minute behind him, and the first ladder company arrived at 0044. So within 3 minutes of dispatch we had a chief officer, one pumper and one ladder company on the scene.

We then had two more engines and another ladder company, with a special dispatch on the second ladder company. The fire took approximately 10 minutes to get under control.

Senator Moss. Isn't that a phenomenal reaction time? That seems so short, I hardly realize how you could get there that fast.

Mr. ANDRUS. The time on the chief officer of course is due to the fact that he was out of the station already, out on the street.

Senator Moss. He was out and rolling on the street.

Mr. ANDRUS. Yes.

Senator Moss. How was the alarm tripped off? How does that work? Is there a heat mechanism that makes it go?

HEAT SENSOR SET OFF ALARM

Mr. ANDRUS. It is a heat sensor. There is one of these located in each room and in other areas of the building. It is a rate-of-rise and fixed-temperature device. As the heat increases, the device will trip or if it reaches 135 degrees it will trip. It is connected directly into our alarm office so there was no problem of dispatch.

Senator Moss. Thank you. You may continue.

Mr. ANDRUS. Now we do have some homes in Salt Lake City that have only a local alarm because of the number of people in them. In the smaller homes it would just ring a bell in the building.

Senator Moss. What is the breaking point on that as to number of occupants?

Mr. ANDRUS. Fewer than 15 persons.

Senator Moss. If there are fewer than 15, they need not have this central alarm system?

Mr. ANDRUS. Right. All they need is a local alarm. These are the laws that Marshal Tanner mentioned in 1963. At that time, Fire Marshal Kresser in Salt Lake City, tried to get a law passed that all

convalescent homes had to be sprinklered, and again compromises were made and these ordinances were a result of those compromises.

Senator Moss. All right. You may proceed.

Mr. ANDRUS. Can we have the lights put out, please.

(Showing of slides.)

This is an overall floor plan of the building; the first floor, second floor, attic. The manager at the time the nursing home alarm went off was in this area here in the basement.

This is a plan of the first floor. The fire originated in this area of this room. The north is to my left. The fire moved out through here, up this stairway to the second floor. Flammable liquid was spread in this area down in this room and in this area in this room and then ignited.

Now the one gentleman who was in this room heard the alarm, opened the door, saw the fire, closed the door, and was subsequently rescued by the fire company. The two gentlemen in this room, their door was closed, they were rescued. The two in this room were taken out by the manager of the convalescent home; he lost one of them halfway down the hall, and this man got on the floor of the living room and our man picked him out of there. We had no fatalities on the first floor.

On the second floor, two men jumped from the window on the north side of this building, one of whom was killed, one is in serious condition in the hospital. The third man climbed out on the window sill and stayed there and he was rescued by the firefighters.

The man in this bed was awake. He had just come back from the rest room. He heard the alarm, tried to wake up the two people in these other beds. He said they were old and could not understand him. He went out this door, out through this way here, awakened two men in these beds and they followed him out. All three of them survived. The other two men in this room died.

In this room a man was found dead in bed, one was found on the floor in this area, another one on the floor in this area.

The men in this room, one was found on the floor in this area and another one over in here.

Senator Moss. All the deaths were on the second floor then.

Mr. ANDRUS. Correct.

This is the front or west view of the nursing home the day after the fire. This is the south end. Now these windows here, we have an interior shot of these. These were broken by the firemen in an attempt to get in, as were these windows.

These are the windows that men jumped from. Now this is a retaining wall. You can see this home was built back into a hill. This is a retaining wall, so this is about 3 feet farther down than what it indicates on the slide.

Mr. HALAMANDARIS. Excuse me. The ledge which we see, is this the ledge from which the gentleman was rescued?

Mr. ANDRUS. Yes. He was right in this area when he was taken off. One jumped out of this window, and the one rescued was in here. Actually it is more of a rain gutter than a ledge; he had hold of a window.

Mr. HALAMANDARIS. If you could go back to the previous slide, the one that shows the front view of the home, the window which we see is the largest in the nursing home and yet three patients died in their room, if I am correct.

Mr. ANDRUS. That is correct. This is the room that all three patients died in.

Mr. HALAMANDARIS. I am curious to know why three patients should die in that particular room.

Mr. ANDRUS. As we go through the interior shots we will get into that.

Mr. HALAMANDARIS. All right.

Mr. ANDRUS. I might mention we have some duplication of slides here that Professor Einhorn is going to go into. He has taken many of the same pictures and he will explain the effects of heat and what happened during the fire.

Senator Moss. All right.

Mr. ANDRUS. Our first crew came in through that front door, the second crew came up around the side and through the back door. Our first duty was the saving of life. This is what they tried to do. They had to get hose lines into operation in order to get into it.

At the time the district chief arrived, the flames were pouring out of this window. At the time the air conditioner was setting right inside the window. This window was on the hallway.

This is the back ramp, the secondary exit from the second floor. At the time this was installed I believe this is the reason this exit was placed in this location rather than more distant, because of the fact that at this point the second floor is on grade. I am sure they felt this was the easiest way for the patients to come out here and down the 26-inch-high ramp rather than down the fire escape, so there were several considerations on it.

This is the night of the fire.

This is the hallway. The fire started in the room right in this area. This is the room in this area where the patients could not get out of bed; however, the door was closed and they were rescued.

This is the fire room. The fire was started in this area here.

This is another view of the same area. The fire went out through this door and burned through this door. This is a door that was never used, permanently closed, and it is still there.

This is the bed where we found what was left of the flammable liquid that started the fire.

You can't see these too well, but these are light bulbs in the room, and Professor Einhorn will explain what the significance of this is.

This is the floor where the fire started after we had cleaned it up. The bubbling in the floor, it is not very plain here but this baseboard becomes fairly clean. At this point coming this way it is charred.

This is the door across the hall, common ordinary hall door, 10 feet away approximately from the origin of the fire, yet that is the extent of the damage.

That is the inside of the door; no damage at all though the smoke seeped around the door frame.

This is the interior of the room. This is the one where they could have made up the beds and gone back into operation, this particular room.

This is the back bedroom. The one occupant in here heard the alarm, thought it was a fire drill, got up, opened the door, saw the flames outside the door, closed the door, proceeded to get dressed, and waited until our men came in and rescued him.

Again this is the inside of this room; no damage at all.

This is the alarm system in the room. This is one of the system's gongs on the first floor and one in the basement. This is the manual pull station, batteries that operate the system in case the power goes out.

Any tampering with the alarm will transmit a trouble alarm to the fire department, so we do have some supervision on these systems.

This is a chair at the base of the stairway. That is the alarm bell laying in the chair.

This is a view of the stairway. Liquid apparently was poured on this platform right at this point and back around the hall into that room you just saw.

Poured through this area, up the stairway on the landing. The manager of the nursing home stated that when he got up there two men were in the doorway and he took them out but there were little fires up in the hall.

The bulk of the fire at this time was inside of the room.

This is the first floor bathroom, the point where the cleaning closet was located. The can of liquid was taken from this area.

This is a view looking straight up the stairway at the time of the fire. The attic was still filled with smoke. This is the window with the air conditioner in it.

A view back down the stairway.

This is straight down the stairway after the debris had been cleaned up. It is like looking down a chimney; in effect it was. You can see the char patterns in the floor. This white area is the tile that was not burned. Part of this area was charred on up around and right where the picture was taken.

This is the door at the head of the stairs. They were installed in the late 1950's or early 1960's by the fire department and the State board of health. The night of the fire this door was open, solid core wooden door. It should hold fire back for 1 hour.

This is another shot of the door; we just closed it to get a picture of the other side. If it is darker you can see it, it is pretty clean on this side.

This is the room out through the back and to the rear exit where one gentleman went through and picked the other two up.

That is going down the ramp into the back yard.

They went out and they left that door open which provided additional draft for the fire.

This is the exterior of the door leading into the room on the south side where two men died, one man got out. As you can see, it is a common door, part of the core is burned away and yet the inside veneer is still intact.

This is the bed inside of that same room with the smoke line coming around at this point just about the bed height.

One victim was found in this area and one was found just to the bottom of where this picture is. In fact, his body was blocking the door. The fire fighters came in and had to force the door and push the body away from it in order to get the door open.

This is the room at the end of the hall where the three men died. The veneer is entirely burned from the front of the door, the hollow core portion is gone, yet the inside veneer is intact.

On the other side of the door it does not look too bad. You can see the veneer, the pattern is the cardboard core.

This indicates to us that this door was partially opened. There was a tremendous smoke area right in here coming up and going up right there. It appears that that door was probably 3 or 4 inches open. One victim was found in this area. This man in this bed was the youngest man in the home, physically active. He rode a bicycle, and yet he died in bed. He was the only one we found still on his bed. The other two men in this room were found on the floor.

These are the other beds in the room. There is not a great deal of damage to those beds.

This is the front window. Now this is taken back, the one we saw of the first views. These windows were broken by the fire fighters. They were double glass. They were painted shut; they could not force the windows, so they had to break them out with an ax.

This is the north bedroom. This is the room that two men jumped from and the other man was rescued from.

Here again now is the chair that is holding that door open.

This is the exterior of the door again. Had that door been closed there probably would have been a chance that all of these people would have survived.

These mattresses are out of the first floor. This, we believe, is the mattress on the bed in the area where the fire started. This was completely consumed. We had one more taken from upstairs in the same condition, nothing left of it.

Senator Moss. Those were very dramatic pictures and they illustrate rather well what the conditions were there. We are glad you brought them.

Were there any autopsies done on the people that died to determine exactly what the cause of death was?

Mr. ANDRUS. Yes. The cause of death, according to the State examiner, was carbon monoxide poisoning and thermal burns.

Senator Moss. Carbon monoxide poisoning and thermal burns.

Mr. ANDRUS. Yes.

Senator Moss. Some of them were burned quite severely?

Mr. ANDRUS. No; I think the burns were superficial. The carbon monoxide seemed to be the big killer. Of course the one man, his injuries were a combination of the carbon monoxide and the jump.

Senator Moss. Yes; the one that jumped and was injured in the fall.

Mr. ANDRUS. Yes.

Senator Moss. And there were six in all that died.

Mr. ANDRUS. Correct. Of the people on that second floor we had four survivors.

Senator Moss. Four survivors and six deaths.

ANNUAL FIRE INSPECTION

Had you been making regular fire inspections? Had the home been inspected?

Mr. ANDRUS. Yes. The last inspection was on the 13th of May of this year. This was done by combat inspectors of the firefighting division who inspect all commercial buildings in their firefighting districts for two reasons: One for fire prevention, and another to familiarize themselves with the building. The last inspection done by my

office was in March of this year. We inspect them once a year for licensing for the State board of health.

Senator Moss. So they get at least one annual inspection.

Are there any other agencies that regularly come?

Mr. ANDRUS. They get one annual inspection from our division at least, and one from the combat division.

Senator Moss. I see. So you would have at least two inspections a year.

Mr. ANDRUS. Right.

Senator Moss. Did this building have an adequate fire plan, a fire drill, to follow?

Mr. ANDRUS. Actually, I don't feel that a fire drill in this type of building was other than for the employees. I don't think there is any way that you can drill the patients because of their mental condition. They are not going to remember from one day to the next what you told them anyway. So I don't believe that there is a practical way to run regular fire drills such as you would with school children.

Senator Moss. Doesn't the code require fire drills though?

Mr. ANDRUS. Yes, the State code requires fire drills.

Senator Moss. But you think that the people in this institution were not capable of carrying out a fire drill?

Mr. ANDRUS. Some of them were, some of them weren't. Now the gentleman on the first floor that thought it was a fire drill—what they have done, they have run the drills for the employees to let the employees know what they are to do. But at the time of the fire there was one employee on duty and it is just not possible for him to cover the areas. As was proven out, he cannot cover the two floors by himself.

Senator Moss. There was only one employee or worker there that night, is that right?

Mr. ANDRUS. Right.

Senator Moss. And he was the operator of the home, he was sleeping there.

Mr. ANDRUS. He told us that he was reading the newspaper.

Senator Moss. But he was there in the home that night.

Mr. ANDRUS. Yes.

Senator Moss. Do you know whether the State has any requirement that there be more than one person on duty in a nursing home, anybody like a practical nurse or anything of that sort at night?

Mr. ANDRUS. Not that I know. Dr. Walter is here from the State board of health and he will be going into all the details on their regulations.

Senator Moss. We didn't say very much about the flammable liquid that you indicated caused the fire in the first place. Where was that flammable liquid stored?

Mr. ANDRUS. It was stored in a cleaning closet off the bathroom on the main floor.

Senator Moss. Is there any regulation about that, about whether this is an improper place of storage?

Mr. ANDRUS. There has not been.

Senator Moss. There has not been. You indicate perhaps the fire regulations might include that.

Mr. ANDRUS. This is going to be one of our recommendations, that any flammable material be kept where a patient cannot get hold of it; kept in a separate part of the building open only to the employees.

Senator Moss. What was this, a cleaning fluid?

Mr. ANDRUS. It was a dust mop treatment fluid, an oil. It is in the flammable liquid category, with a very high flash point.

Senator Moss. High flash point.

Now, in your comments on the slide you talked about the stairwell being like a chimney. Is that really what it was that night, a chimney that drew the flame up rapidly?

Mr. ANDRUS. It was.

Senator Moss. From the first floor to the second.

Mr. ANDRUS. That is right. This happens in any fire where the flame and smoke and heat is going to go up. The stairwell is a natural chimney for it to occur in. We have had fires in apartment houses in Salt Lake City where we have lost lives for the same reason.

Senator Moss. If all the doors on the second floor had been closed, would that have retarded the chimney effect?

Mr. ANDRUS. I am sure if that door on the top of the stairway had been closed that the fire would have vented out the window to the east, as it did, and it would have reduced the damage.

Senator Moss. So part of the problem was having the door open up there on the second floor.

Mr. ANDRUS. Right. This is part of the problem with this type of equipment in hotels, apartment houses, nursing homes, wherever you put it. It is something that has to be policed, something subject to tampering. We don't have the manpower to police it. Tampering is so easily done. From the time we walk out on inspection they might block that door 5 minutes after we walk out, so the protection as far as I am concerned has to be fixed protection and reasonably untampered with.

Senator Moss. This low flame started by the flammable liquid—would a sprinkler system have been able to dampen this down enough, do you think, to keep it from being a roaring furnace as it was?

Mr. ANDRUS. I believe it would have; yes, sir.

Senator Moss. Do you think a sprinkler might well have saved the lives on the second floor?

Mr. ANDRUS. I do.

Senator Moss. Now, as a result of this I take it you have prepared some recommendations for altering the fire code. Could you quickly give me those recommendations.

RECOMMENDATIONS FOR FIRE CODE

Mr. ANDRUS. Yes. These were presented for the Salt Lake City Commission yesterday by Chief DeKorver of our city. The State will probably set up fire standards for these occupancies, and these will be based on NFPA 101. However, there are a number of items to be considered.

1. Rules have been more strict for nonambulatory patients. The term "nonambulatory" has generally been used in connection with the physical condition of patients. I believe that consideration should be given to mental condition also, and that certain medications can change a person's mental condition.

2. Automatic sprinkler systems should be required in all convalescent and nursing homes. These systems should be provided with water flow and tamper alarms connected with the fire department or an

approved fire alarm company, as outlined in section 15–27–3, revised ordinances of Salt Lake City.

3. Door closers as specified in section 3309, paragraph 6, Uniform Building Code, should be required on all doors in stairway enclosures.

4. Exit requirements should be as specified in section 3318, Uniform Building Code, 1970 edition.

We did continue on into schools and day nurseries.

Senator Moss. I see. Those are the ones applying to nursing homes and convalescent homes.

Mr. ANDRUS. Correct.

Senator Moss. Is this door closer one of these springs that shut the door?

Mr. ANDRUS. No. This particular one is a magnetic hold-open device, and it is tied into the alarm system that would be tied into the sprinkler system. As soon as this alarm system sends a signal, this kills the electric magnet and allows the door to close so that even the problem, in these places, of ventilation—that is the reason they block these doors open, so this way they will be able to have the doors open and still have them close in case of a fire.

Senator Moss. Are there some nursing homes that do have sprinkler systems in them in Salt Lake City?

Mr. ANDRUS. Yes.

Senator Moss. What has been your experience? Have you had fires that have been controlled by sprinklers satisfactorily?

Mr. ANDRUS. We don't get all the records on these fires like we should because apparently we have had some small fires, and the sprinkler systems put the fires out. These present systems are not hooked into alarm systems so we had no waterflow alarm. The maintenance man replaces the sprinkler head and we never hear about it.

Senator Moss. But your recommendation would be that you do get a notification if the sprinkler system is tripped, is that right?

TIE ALARM SYSTEM INTO FIRE DEPARTMENT

Mr. ANDRUS. Yes; because in the case of an arson fire, where we get a flash fire, there is a chance that that fire flashing would open so many heads that it would override the sprinkler system. We would like to be notified so we can add additional water into the sprinkler system through our pumps.

Senator Moss. These rooms were carpeted, I guess, all of them, were they, in this nursing home?

Mr. ANDRUS. No, there is no carpeting in the rooms themselves. There are tiled floors in there, either asphalt or rubber asphalt tile. The carpeting was in the hallway for about 20 feet on the main floor and up the stairway. There was a break between this carpeting and the stairway carpeting where it was. There was no carpeting in the hallways, or the rooms. There is carpeting in the front room but this was not involved in the fire.

Senator Moss. Did the carpeting play any part in the flammability? Was it particularly flammable or did you test it?

Mr. ANDRUS. Professor Einhorn will be going into this. He ran the tests on that and he will be covering this in his testimony.

Senator Moss. Fine.

Now do you have anything more to offer, Mr. Tanner?

Mr. TANNER. I would like to talk for a moment on what we are going to do in the State of Utah.

Senator Moss. All right.

Mr. TANNER. In answer to your previous question, I might state that 10 days ago at the Nobel Manor, which is located in Salt Lake County, a fully sprinklered home, a patient set fire to a linen closet. Two heads opened; the fire was completely controlled. Total damage was $250. Very little smoke.

Six months previous to that we had a fire in the Hillside Manor that completely sprinklered the building. Here again one sprinkler head opened, again in the closet. The fire was controlled. There was no panic. Very little smoke.

Those are the only two recent incidents we know about. At the State hospital, which is completely sprinklered, they had two inmates set fire to a large clothing room, and the fire was controlled with the two sprinkler heads. Previous to the installation of the system, we had a similar fire in the clothing room and 350 patients had to be evacuated from the building. The fire was going up through the second floor at the State hospital when the fire department stopped the fire. So here we have two similar incidents, one where we had to evacuate and it was just touch and go getting these people out.

Senator Moss. Pretty good recommendation for sprinklers.

Mr. TANNER. Yes.

PUBLIC HEARINGS ON RECOMMENDATION

Now, following this tragic fire, Governor Rampton called a meeting of the State agencies particularly involved—the State board of health, the State welfare department, the State fire marshal's office—and at that time we discussed the various aspects of this fire and what was needed in the future. He asked the State fire prevention board to make recommendations to his office, which we did, and on September 24 following the receipt of a letter from Governor Rampton concurring in our recommendation, the board met and discussed what they proposed to adopt. In Utah we always have a public hearing before we adopt regulations, and that will be held tomorrow in Salt Lake City in the State auditorium. We invited all parties concerned to this public hearing.

Primarily what we plan to do is adopt the Life Safety Code, the 1970 edition as it presently stands with one exception. We are also going to require sprinkler systems in those buildings of fire-resistive construction which at the present time are not covered in the 1970 code. We will also cover various other gray areas.

We have some retarded kiddies in many of our homes that are not presently covered under the nursing home law. We have some elderly people—and here we go back to the board-and-room type of thing—small groups that are not considered as nursing homes that we want to cover. So we are going to adopt a residential custodial care definition of the safety code. This will cover many of the areas not presently covered under present law.

Senator Moss. I appreciate that and I am glad to know that the Governor and the State board moved to promptly upgrade the fire requirements there. At least, we have had that much favorable action for preventing recurrence.

Do you have any questions?

Mr. HALAMANDARIS. No questions.

Senator Moss. Do you have questions?

Mr. MILLER. No.

Senator Moss. We do thank you, Marshal Tanner and Marshal Andrus, for coming here to give us the outlines and tell us what occurred in this tragic fire.

Mr. ANDRUS. Thank you.

Mr. TANNER. Thank you.

Senator Moss. We do want to hear from Professor Einhorn, and also Dr. Walter so we will move on and ask Professor Einhorn if he will come to the table.

Professor Einhorn is from the University of Utah. He is director of the flammability research center, and adjunct professor, department of chemical engineering. Professor Einhorn is one of the leading specialists on flammability, an outstanding man, and we are fortunate that he was there at the time to see the results and to give us some expert testimony as to what occurred and what else we need to know about fire.

We look forward to having your testimony, Dr. Einhorn, if you will go ahead.

STATEMENT OF IRVING N. EINHORN, DIVISION OF MATERIALS SCIENCE AND ENGINEERING, ADJUNCT PROFESSOR, DEPARTMENT OF CHEMICAL ENGINEERING; DIRECTOR, FLAMMABILITY RESEARCH CENTER, UNIVERSITY OF UTAH, SALT LAKE CITY, UTAH

Professor EINHORN. Thank you.

I would like to comment that initially I will talk about the ignition, propagation, and smoke development that occurred in the Lil-Haven Nursing Home fire. We have completed about 90 percent of our examination; there are still some new materials we have just received and we are investigating these. We also, if it is desired, have taken samples from quite a number of the rooms where we have been able to find a series of plastics and other materials that indicate melting on various locations. If desired, we think we could pinpoint within a few degrees the temperature profile in these rooms.

This particular fire was a very fast fire and I will have some demonstrations here in a few minutes of the accelerant and its effect on the materials. I would like to show some slides; some of them will be duplications of scenes shown previously by Marshal Andrus. I would like to talk about this from a different aspect and comment on the nature of the burning patterns.

The first slide is a view of the west side, or front of the building, indicating there was very little damage. There was some smoke seepage around the soffit area which is typical of this type of fire. This again points out the windows in the front room were broken by the firefighters in an attempt to enter the area. We do see a fair amount of damage both on the first floor and on the second floor. The first floor room was one of the two rooms together with the stairwell areas which were badly burned. The room upstairs is only moderately burned.

The back portion—and Marshal Andrus had a better picture of this—showed considerable flame damage.

The south side showed very little damage.

Now in the room of the origin of the fire we do see an interesting pattern of the two light bulbs. When a light bulb is exposed to temperature it will melt toward the hottest area, and thus point out the origin of the fire. Considerable damage occurred in this room, both the wall and ceiling areas had five and six layers of paper which had burned off. There was evidence of a high amount of combustion in the mattress.

You can see also that the burn-through occurred in the roof area, and there was substantial charring to the depth of about one-half inch on the wood roof supports.

A Quick, Hot Fire

Another view—soot pattern behind the bed in this particular room—showed again the evidence of a rather quick, hot fire.

I think again to point up that the total time estimated from the time of the alarm to the time the fire was under control was approximately 10 to 12 minutes. The char depths in the area here ranged as deep as one-half inch and in the hall area almost three-fourths of an inch. This is typical of an extremely hot fire.

The next slide shows the bathroom area. The burn-through occurred from the point of origin into this room. There were a number of plastic fixtures in the bathroom which did melt. There was some plastic tile on the wall in this area.

The stairwell was very hot, perhaps the most intense area of combustion. The char area along the left side shows that char depths ranged between one-half inch and as high as three-fourths of an inch—a very, very hot fire in this area.

The hallway was finished with a combination of materials. We have only recently received some of these materials for study. These materials may have played a part in the spread of the fire. We had one finishing which is rather old and we are analyzing this by means of infrared spectroscopy, and we will try to pin down its chemical structure.

The interesting point with the hall doors was their resistance to burn through. Had these doors remained closed they would have offered a substantial barrier. There is indication by the smoke patterns that the doors were not closed. These were the typical hollow-core doors and they should offer about 10 minutes' protection. As the slide shows, the other side of the door showed little damage.

It is interesting to note there are very little soot patterns to the right of the door. The nail heads which are used to hold the composition board in place transmitted heat, and you can see evidence of char buildup here. More important is the level at which the smoke occurs in this room; the soot pattern indicated the hazard to life support to those in the beds.

The next slide shows the front room where three of the victims died. There was very little evidence of fire in this room; very little evidence of heavy char. The ceiling tiles did buckle, but these were buckled out by heat and then only in the center of the room. We examined the

composition of the soot on the light bulbs, but found only hydrocarbon material.

Slides taken in the west bedroom—2d floor—illustrate some interesting patterns. You can see in this front room that there was evidence of high air velocities as shown by the patterns of the charring soot formation. In this room, located somewhat above the bed level the west wall was hardly discolored. Initially, we thought the fingerprints on the wall might have been those made by one of the victims trying to get out. A closer examination of this shows they were glove prints; in fact, these were, identical to gloves used by the firefighters. We also checked with the nursing-home personnel and none of the people were ever known to have worn gloves in this area.

Again the bed clothes are quite clean, very little smoke in this particular room.

We would estimate the temperature in this room was probably 200° F., which will support life for a modest period of time.

There were five layers of wallpaper on the ceiling of the middle bedroom—2d floor. An interesting note here is that the door protected the closet area. There was no damage or discoloration of the clothing and yet just next to the door it was burned through the wall.

The bedroom areas had a slight staining discoloration on the bed clothes, due to condensation.

And again the windows through which two men exited this room.

There was some pattern of burn in the room but again not as much as you would expect. This indicates that the carbon monoxide plus temperature probably played the principal role in causing death. This was borne out in subsequent autopsy results.

Here again you see the pattern of the door partially burned. Had this door remained closed, there is a good chance that the people who died in this area would have survived.

Now, it is interesting to note that as you look at the char pattern on the far wall that this is just about the level of the height of the bed. This is again typical of a fast fire. If it had been a slow fire, you would normally see a soot pattern over the entire wall. So it is quite possible that when the people moved out of the bed to stand up, they moved into the area of reduced oxygen.

Again in the back bedroom you see this pattern of soot just about the bed level, and this is true here of the door.

The next slide was taken in the back room. The fire burned through the ceiling, producing a very heavy char; plaster fell off of the wall, and yet because of the one man actually helping the people out, the people in this room were rescued. This room received more fire damage than the other rooms where people died.

The front room just west of the area where the fire originated exhibited a series of melt patterns as shown by the melting of plastic decorations.

The draperies did melt away from the support, but they did not ignite. In fact, we have some drippings that were found on an uncovered urethane pad. This pad did not ignite.

Another room, located to the southeast of the origin site, was essentially undamaged and with a slight cleanup could have been placed back in operation in a short period of time.

Laboratory Examination and Analysis

Tests were conducted of materials taken from the fire scene. The carpeting was nylon with a tight industrial weave and a polypropylene backing and a jute underlayment.

Ignition Test

The "pill test" was used to test compliance with existing standards. The reason for using the pill is that it essentially gives you a constant source of B.t.u.'s or heat. I will demonstrate this test procedure. Failure in this test would be to exceed a 6-inch diameter. You may get a little more burn here because it is not in a container, but basically on this particular test of the six samples that we ran, four of them passed completely without—they all passed; two of them came very close to the failure point.

Similar tests were run at the National Bureau of Standards and similar results were observed. The "pill test" is a first generation test and is not a very severe test. Surface area, such as encountered in a high pile or shag carpet would produce a far greater burn.

In the Lil-Haven fire an accelerant was used. A gallon can containing a flammable liquid was found in the room of the fire origin. Interrogation of the individual who started the fire confirmed that arson was involved. Infrared analysis was used to identify the contents of the can.

The infrared analysis indicated the liquid was a hydrocarbon. a call was made to the Century Chemical Co., and they told us that they received the material from the Fracture Chemical Co.

Samples were obtained from the chemical company and the infrared analyses were identical with those of the material found at the fire site. There is no adulteration of this material. We now know that the material is a refined white mineral oil; it is 35 Base Oil manufactured by the Shell Chemical Co.

Now if we take a similar piece of carpeting—as just used in the pill test—and place 2 millimeters of the accelerant on the specimen and use a match as the ignition source you will observe a marked difference in the burn pattern.

A very hot fire develops which will spread quite rapidly, while producing a fair amount of smoke. This pattern would be magnified in a stairway where you do have a chimney effect, as encountered in the Lil-Haven fire. Thus you can see why in this particular case the fire spread quite rapidly.

We estimate that this particular fire would burn about 1800° F.

We have taken some wool carpets which passed the "pill test" and obtained the same rapid flame propagation when the accelerant was used. It is our feeling that had sprinklers been installed in this area, they would have contained the fire and possibly prevented loss of life.

Now, I would like to show you some slides of other flammability tests that were run in our laboratory. The first test is the ASTM D–1692 test. It is a small scale test and we have ignition by a Tyril burner equipped with a wing type. This carpet was tested without

the accelerant. At 30 seconds, we have a flame roughly 2 inches in height. We do have benchmarks 1, 2, 3, 4, 5 and then 6 inches along the carpeting.

At approximately 1 minute we have a high, hot flame. At this point the burner was removed. We have not burned to the 1 inch point. The actual figures are in the report.* Maximum propagation was about ½ inch. Thus, we do not classify the specimen as a high combustibility material.

The test was repeated using 2 ml. of the accelerant on the carpet which in this case was ignited with a match with a three second ignition time. At 5 seconds the flames were observed approaching the 1-inch point, at 30 seconds propagation was about 3 inches, with a height of 4 inches. Again the horizontal position is the least propagating. You can see the typical type of hot fire that we are getting even in this position. The flame continued to burn for almost 5 minutes.

Now we take the 45-degree test which is somewhere in between the horizontal and vertical, again typical of the stairwell situation, igniting with the burn. We did this in 60 seconds, 15, and 5 seconds ignition. Even with a 60-second ignition, you will notice that we again have slow propagation, with a flame height of about 14–15 inches.

When the carpet specimen is ignited after adding 5 millimeters of the fluid, the entire sample was observed to burn in 20 seconds. A hot flame, of about 2,000 degrees was observed. The flames were about 20 inches above the sample.

In the vertical position, propagation is not only rapid, but, after about 20 seconds the materials will drip off and we will have a very hot fire at something over 2,000 degrees at the base of the test stand.

Smoke Density Tests

In addition to the ignition tests, we have run smoke index using the P–2 evaluation smoke-density chamber. Without the accelerant we did have rather low smoke production. In fact, in the 2-by-2-by-1-inch sample at the end of 480 seconds, we had only 40 percent light obscuration. On the other hand, when we used the 5 millimeters of accelerant at the end of approximately 90 seconds we had essentially 100 percent light obscuration.

Limiting Oxygen Test

The oxygen index test is used to measure the effect of oxygen concentration in sustaining combustion. A sample of carpet obtained at the fire scene was evaluated using the oxygen index test. A value of 20.2 percent oxygen was required to sustain combustion. This value is very close to the amount of oxygen found in air. When the carpet sample was evaluated with 5 ml. of accelerant, an oxygen index value of 14 was obtained; this indicated it would burn without initial oxygen.

In summary, from the results of this analysis on these particular samples we feel that the carpeting was only moderately combustible and that the accelerant played a dramatic part in this fire.

We did examine several other materials which Marshal Andrus gave us. One was a plywood panel painted with a gray paint. This was located in the hallway area and up the stair area.

*Retained in committee files.

This material evaluated by the Bureau of Mines burn-through test, a test that measures penetration, indicated a burn-through time ranging from 100 to 130 seconds, depending upon whether the cleaning surface was in contact or away from contact of the flame source.

We also had received plastic tiles taken from the bathroom. These we believe are vinyl. These melted, giving off a fair amount of smoke and a high concentration of what appears to be hydrogen chloride. So, basically, there were other materials involved. However, we don't believe these played a large part in the fire.

Examination of some of the plastics found in the Lil-Haven Nursing Home was quite interesting. The toilet paper holder was plastic and it melted though there was no charring of the toilet paper. There was one place where the plastic tiles about fell away from the wall and a towel located on a rack in front of the tiles was not damaged.

Flammability Evaluation Test

There have been a large number of test methods promulgated. In fact, in a recent book that I have just finished writing we identify 368 test methods used to characterize the flammability characteristics of materials. Of these we believe only five or six are worthwhile. They give rather erroneous results, and this agrees with Professor Emmon's report that he made a few years ago.

A great deal of emphasis is placed on ignition and propagation of material after flame contact. Yet except for clothing fires or aircraft fires where you have tremendous fuel sources in most cases the cause of death is carbon monoxide poisoning and temperature.

If I had to list the six factors which cause death, be it in automobiles or nursing homes or any confined-space fires, I would say the first cause is depletion of oxygen asphyxiation coupled with temperature. Now we carry out body functions at approximately 21-percent oxygen. At 16-percent oxygen concentration, an individual becomes sluggish; at 14 percent, he fatigues, and at 6 percent, he dies in a few minutes.

A typical home fire will probably reach 500 degrees in 5 minutes, 1,000 degrees in 10 minutes. An individual can survive a temperature of 300° F. for a few minutes; he can even withstand 800° F., with his mouth taped shut for a very short time. The pressure of CO, or other fire gases, would drastically reduce the threshold for survival. We are just beginning, from the legislative point, to promulgate legislation involving smoke which prevents egress from a fire area. If you do egress the area, the question must be asked, what are the short-term and long-term effects on individuals? We cannot consider the above factors independently.

A person is really exposed to all of these factors simultaneously so I think it is very important to realize and I think we do, that when we fire retard a material we actually get an incomplete combustion. This will contribute almost exponentially to the rise in smoke and to the development of toxic byproducts. The halogenated fire retardants used today may effectively reduce the burning process but they produce toxic and corrective gases, heavy smokes; which will affect systems and organs and may cause death.

So we must look at the total picture encountered during a fire. Just to reduce flame propagation during a fire at the expense of smoke or toxicity is the wrong approach.

Senator Moss. Is it your understanding that these people died of carbon monoxide?

Professor EINHORN. Dr. Weston, the medical examiner for the State of Utah and a member of the Flammability Research Center, advised that carbon monoxide was the principal cause of death.

It is interesting to note that in a report we did for the National Aeronautics and Space Administration we have identified very toxic materials and we burned these in a number of conditions using rats. Dr. Weston, in this particular program, performed a complete analysis of our animals. He examined heart, lung, liver, spleen, brain, pelvic organs. The fluorinated degradation products, such as Hf and CO_2 caused complete opacification of eyeballs of the rats in 15 seconds. However, this was not the cause of death. I would like to read from Dr. Weston's summary to me in this report.

The examination of the exposed rats indicated an absence of any significant cause of death except carbon monoxide poisoning.

Dr. Weston points out the carbon monoxide hemoglobin contents were as high as 98 percent. So even though we had other materials, the principal cause of death in those cases was still CO. We have now before NSF and NIH proposals for a 3-year investigation of the effect on nerve velocity, muscle velocity, effect on sight, tissue and organ functions, of gases produced during combustion. Thus, if funded, we hope to determine the relative importance of fire gases on life.

CARBON MONOXIDE POISONING

We know in typical home fires, such as the Lil-Haven fire, people are found out of the beds, within a few feet of the bed. In the typical fire where a person is smoking on a mattress or upholstered chair, the individual may move 5 to 15 feet from the original position but they do not exit. We know from research studies that have showed in this case a fire does not actually break out for 3 to 5 hours but a person is dead probably in 30 to 45 minutes from carbon monoxide poisoning.

Senator Moss. That results from incomplete combustion.

Professor EINHORN. Yes.

Senator Moss. So you say some of these fire-retardant materials we use, which cut down on combustion, might be more dangerous than if we didn't have them at all.

Professor EINHORN. I think in part that is true. Senator Moss, take a look at the total picture. We have in the construction area tended to make buildings safe rather than "people safe." We have been more concerned with replacement damages. Tests which are widely accepted in most building codes indicate this, and we have been striving for a 25 rating or a 50 rating for flame propagation. In my opinion, and I have mentioned this in a number of seminars that I have participated in, we might raise this valve to 75. It might cost a little more to put the building back into shape but at the same time we would be able to bring people out because the smoke factor would be less and the toxicity factor would be less.

Another aspect, we saw in the Lil-Haven fire was the fact that the rate of rise of temperature did trigger the alarm. However, I think we are far behind some of the detection devices that I noticed in Europe

2 years ago when I attended the Nordic Fire Protection Association meeting in Stockholm. They have devices which sell for $100 and $150 which will employ rate of rise, ionization detectors, and measure particulate matter.

If we required multiple detection equipment, I think we would have a much more reliable system. We have them in our own home in our heater room and in each of the hallways. I think nursing homes, geriatric homes, and other public buildings, should be required to install devices of this type.

Another aspect that we have seen in the State of Utah and heard reported by other areas is a number of deaths in mobile homes and campers resulting from carbon monoxide poisoning. We had a situation in the early part of this year where two officers cooked dinner on a charcoal stove, then placed the stove in the camper to provide heat. They were both found dead the next morning. A detection device would ring a bell and would save lives. The cost of such a device is insignificant.

Senator Moss. Could the oxygen supply in an unventilated room be lowered to a dangerous point by a group of people just smoking tobacco?

Professor EINHORN. I think you can probably have an incident where it would but I think in most rooms that we have there is sufficient leakage that this would not occur. You might have a smoke factor. We occasionally checked our device and actually have an alarm maybe once a month as a fire drill with our children. We keep this device attuned so that it will go off at 135 Fahrenheit or in the presence of a very light cloud of smoke.

Senator Moss. The alarm is very sensitive then and would detect it quickly.

RELIABLE ALARM DEVICE AT LIL-HAVEN

Professor EINHORN. Yes. Now I think the alarm located in the Lil-Haven Nursing Home was a reliable device. Marshall Andrus checked this after the fire. It was also tested by Underwriters Laboratories and certified as a very reliable device. I think this alarm device that sounded the alarm at the Lil-Haven Home is a very good one. I just think we can make it more effective by adding the other types of detectors.

Senator Moss. I understand from your testimony that carbon monoxide poisoning is quicker, more lethal, if the temperature is high; is that correct?

Professor EINHORN. We get a synergistic effect. We have run studies in the NASA report where basically we first examined oxygen at ambient temperatures. We began to reduce the amount of oxygen from the amount of 21 to 16 to 11 to 7. When we got down into the range of 15–16 percent the laboratory animals began to become sluggish, they fatigued readily. This is typical. When we begin to raise the temperature we get a synergistic effect so that the life support decreases.

Now as we begin to add carbon monoxide to the oxygen, to the temperature, we hit levels, for instance, at about .075 to .10 volume percent carbon monoxide. Even at 21 percent oxygen and ambient temperature we can kill three to four rats even if we introduced a very small amount of carbon dioxide which occurs. First, this is relatively

harmless but it causes the respiratory rate to increase. So now we inhale more of the other gases present.

When a wool carpet burns there is a substantial amount of hydrogen cyanate given off many, many times above the lethal level. This combined with temperature and CO reduces the threshold for life support. For example, we may expose an animal to 150 parts per million of HCN and not have death occur. But when we combine a temperature of 120 degrees, a CO level of 0.075—a level which by itself would not be lethal—it requires only 50 p.p.m. of HCN to cause death. This is one-third the amount which if we had, say, 85° F. would cause death. This is the area that has not been studied in any real depth and much research is required to obtain the needed data.

Underwriter's Laboratory Report No. 53 cited some 297 references in toxicology but they were individual studies, the animals were not retained for long-time exposures. Now with our medical people we have developed a device where it is simply a rotating bar. We can take an animal, measure his response, say 18 hours after exposure, and predict long-range response. After examining 500 animals only one of those that showed inability lived 14 days after successfully passing the bar test. This is the LD 50 test commonly used.

So we do think we have some test procedures now which will allow us to look into physiological response and with the work we are doing now and hope to do in the future nerve velocity impulse, muscle velocity should permit us to better evaluate human response to fire. We think we will be able to say which factors in a fire actually are most important, and more important than this to determine what immediate treatment to render so as to minimize injury.

In some of our experiments we have had our animals showing thoracic and head convulsions, and with previous studies we know that they were only 10 or 15 seconds away from death. We stopped the burning and flushed the cage with oxygen and some of these animals were revived. So, we are looking now for aspects of firefighters and people who have been exposed on the way to medical treatment and we think we may come up with some preventive measure this way.

Senator Moss. I am listening to you and I am fascinated with the information you are giving us. There is really a great deal of research yet to be done in this field, I take it, from what you have been saying.

Professor EINHORN. Yes, I think this is true.

Now it is interesting to note where we can go and with what materials we have today. We had a very bad fire 2 years ago at the Salt Lake City Airport with a 727 crash which I am sure you remember. Recently there was a joint test between the National Aeronautics and Space Administration and the Ames Research Center. This test was held a year ago, August, at Otis Air Force Base where some new materials were used to protect the interior of a C–47 aircraft in a large fire. This was a 5,000 gallon JP–4 fire. A volume which is approximately one-fifth the fuel loading of a 707 aircraft. Normal burnthrough would be 20 seconds, thus the survival time would be 20 to 40 seconds.

The control part, the 25-foot section of that aircraft which was protected was completely destroyed in 22 seconds with temperatures exceeding 2,158 degrees. The test section actually shows that the aluminum melted off and we developed a char structure which then offered

substantial protection to the cabin. At the end of 10.1 minutes the fire was extinguished. There was not a high smoke concentration. The internal temperature did not exceed 165° F. and in fact we believe that people would have lived through this fire. This is an example of engineering design with today's materials.

We developed some new materials at the university which we believe could give people an hour's protection in such a fire. What we are saying is that maybe we can design an aircraft of this sort with this type of material. We have talked to the principal builders of aircraft, such as Boeing and McDonnell-Douglass and they are very much interested.

National Fire Testng Center

Senator Moss. You heard my statement at the beginning about establishing a National Fire Testing Center at the University of Utah. Is the equipment pretty much in place that that could be done?

Professor Einhorn. Yes. We need a few additional items of equipment, but I think we can say that we have worked very closely with the Bureau of Standards, the Department of Transportation and other agencies; NASA and FAA. I think we can probably say we have a very unique situation not only in our fire test but the other programs. We already established the Flammability Research Center, our faculty has many joint appointments. We have neurologists, pathologists, toxicologists working with us. Our chemistry department is one of the best in the country and has been named a "Center of Excellence." We have many outstanding people who are well known in the combustion field.

Senator Moss. Well, we certainly do appreciate your coming to give us the information on this particular fire and to explain really how this was propagated, why it became so hot so fast and caused the death of those people all on the second floor.

Professor Einhorn. And principally these were carbon monoxide poisonings.

Senator Moss. In fact, the 93-year-old man that allegedly started the fire survived all right.

Professor Einhorn. Yes.

Senator Moss. Do you have any questions?

Mr. Miller. Yes, Mr. Chairman.

Professor Einhorn, it has been reported that the fire department was extremely prompt in responding to the situation. Would you care to venture a judgment as to additional losses in life and so forth that might have been incurred had that response been delayed a minute, 3 minutes or any other appropriate length of time?

Quick Response Saved Lives

Professor Einhorn. I think there were several things that were really to our advantage. This was a case where the battalion chief, who responded to the fire, was one of the most active and competent in the city and was just a few blocks away; he was there in less than a minute. Normally this is not the case. Normally he comes after the firefighters are deployed. In fact, he was on the radio as the trucks were arriving telling them what the situation was and how to deploy, so this was an important factor.

The fact that one fire station was just a short distance away and that they were there within 2 minutes after the alarm was sounded and we assume that it took only a minute before the type of fire went off in the ignition, I would say that in a normal situation we would have had more loss of life and possibly all of it.

Mr. MILLER. In other words, there was really a substantial saving of life because of the extreme efficiency.

Professor EINHORN. Because the firefighters knew what the situation was even before they approached and he had described the back area which was the exit area as in flame, and I think this really saved us.

Now again one of these unfortunate things was that these doors remained closed. Had the door at the top of the stairway remained closed, I think the chimney effect would have been reduced and if there had been sprinklers, I think there would have been minor damage but not loss of life.

Mr. MILLER. We are all aware of the debt owed to the firefighters but this is a case where they were extremely efficient.

Professor EINHORN. I don't think you get many situations where the fire department arrives and has this type of background in such a short period of time.

Senator Moss. Do you have a question?

Mr. HALAMANDARIS. Yes, Mr. Chairman.

Senator Moss. Val has a question.

Mr. HALAMANDARIS. Prof. Einhorn, you described the pill test as something very mild. The question I have is; what kind of standard do you think we need to protect consumers; and second, do we need a higher standard to protect those who are not ambulatory? What would you recommend?

Professor EINHORN. Let's answer the second question first. Yes, I think we definitely need better standards in geriatric homes—nursing homes. I think it is a good example. People who are elderly, possibly senile—we had one mentally retarded person. It is interesting to note, and I think Dr. Walter will have comments on this, I don't want to take this completely away from him—but one of the men was aware enough that he opened the door, he shut the door, he realized this was not a fire alarm test, that this was the real thing. He closed the door and got dressed. So he had been trained. Again it depends on the competency of individuals.

Under the Hill-Burton Act you do require a tunnel test rating of 75 on carpeting; I think it is a much more realistic test. We worked very closely with Dr. Clark; as a matter of fact, he was a lecturer in our fire seminar this past summer for an entire week and then I went with him to the Gordon Research Textile Conference. The pill test is only a first generation test, it is a start. We have a tremendous amount of resentment. It took a long time to get the nightwear standard through and that has just gone into actual law just recently.

I feel the pill test is a very minor test. It depends a great deal on the nature of the carpeting. If we have a tight weave, which is typical in most homes or industrial places because of wear, then it is not going to burn rapidly. If you go back to the California fire where you had a high pile acrylic, a spark came out of a fireplace and he lost essentially half his house. It was documented in the FPA Journal and received rather substantial publicity. The minister saw the ignition take place but he could not put it out.

If you get into an area in a home where you have a shag carpet, we have seen situations where I can take many, of the tablets, drop them on the carpet and we may propagate or may not. The same thing is true using a match as an ignition source. It depends how the match drops. If the match drops at an angle, it will burn down and burn along the interface between the primary backing and you can have a substantial fire.

So I think we need something more. I know the Bureau of Standards people are working towards this and I think the pill test is a good first start—it eliminates some of the hazardous materials, unfortunately not all of them. Again we face several factors. In most of the standards we don't have a permanence requirement. In other words, if we have a material fire retardant, in the case of most carpeting or synthetic textiles we cannot put in reactive types so we add additives.

Do they come out with dry cleaning? Do they come out with the effect of humidity agent or sunlight? What about carpeting, the fraying of nylon fibers where we split the fibers? This means more surface areas. As these carpets become dirty, they will burn more readily. So I think we need a test that says not only that it is good today but it is good 5 years from now or whatever the expected lifetime of the material is.

Mr. MILLER. You made reference to the greater flammability if the carpet is frayed or dirty. Is there a difference in risk involved in different types of cleaning fluids that might be used in cleaning the carpets?

Professor EINHORN. I think the answer is definitely yes. I don't think we know enough about this. It depends what the chemistry of the fibers is. If we have an additive type retardant, even soap and water may effect its useful life.

For example, let us consider the new test on the nightwear which bothers me to some degree because we have been talking about phosphate detergents and their effect on the ecology. If you use a phosphate detergent and go through 50 washings, one can measure the retained flammability characteristics and predict approximately 1 year's life service. But if you wash that same material with another detergent such as a carbonate you may destroy the phosphate fire retardant effect which at the present time is one of our most effective. So we have to be very careful as to what we specify as a permanent criteria.

Senator Moss. Well, thank you very much, Professor Einhorn.

Your prepared statement and this analysis that is so well done will be made a part of the record. It has many charts and diagrams that are certainly of great value.*

We do appreciate your coming to testify and are fortunate that you were available to do the work on the results of this fire and be able to tell us as much about it as we have been able to learn. We are very grateful to you.

Professor EINHORN. Thank you.

Senator Moss. Dr. Bruce Walter, director of the Bureau of Medical Care Services for the Division of Health in Utah.

We are pleased to have you, Dr. Walter, and we would like to have you tell us what happened to these people.

*See app. 1, items 2 and 3 pps. 1666–1730.

STATEMENT OF DR. BRUCE A. WALTER,* DIRECTOR, BUREAU OF MEDICAL CARE SERVICES, STATE OF UTAH DIVISION OF HEALTH

Dr. WALTER. Thank you Senator Moss. And thank you for the opportunity to give my version along with recommendations that I have based on this fire. I am particularly concerned not only with the fire, which was a tragedy, but that we have the ingredients in Utah and I am sure in all the other States and territories to have a repeat performance of this same situation.

I look on this as an opportunity to work on the prevention of new episodes, to minimize them if they do happen—they can and probably will—and to bring about certain controls and safety measures if they do happen.

This particular fire brought about a number of points that are not altogether fire related but do have an effect on loss of life and so forth, which I believe are important to consider.

First of all, supervision at night, this is a major problem in many of our nursing homes, and especially in intermediate care facilities. Intermediate care facilities also are somewhat limited in medical and nursing supervision.

Second is the availability of substances that support combustion, this has been well shown by others.

Others include combustible construction materials, very poor ventilation leading to the propping open of doors, the use of residential type doors near stair wells, an alternate fire exit which was located next to the stair well and no sprinkler system whatsoever to quell the fire.

In spite of the extremely rapid response by the fire department we still lost lives. In addition, there was an extremely rapid response from the disaster program for which, Senator Moss, we thank you. You assisted us in funding the position to develop this program.

I might add, as a result of this an ambulance arrived within 4 minutes of notification and within 12 minutes there were seven emergency vehicles on the scene.

Now, as far as the direct fire related recommendations, I will make these rather specific ones. Several have been made already and I will second these. First, it appears to me that sprinkling systems are the way to go, and as you have heard Mr. Tanner has already told you that we are moving in this direction. The nature of the patients and their infirmities are important in this regard. No matter how good the response is and how fast, these patients do not respond well even when there are drills.

In the case of the patient who thought this fire was a drill he was in complete control of his faculties.

In other cases patients are not in complete control of their faculties since they may be under sedation at night. Thus, it is important to have some type of fire quenching mechanism that works, for in many cases the patients must be carried out. There is no time for wheeled stretchers or any type of similar assistance. They must be carried out.

FINANCING FOR SPRINKLING SYSTEM A PROBLEM

A sprinkling system will bring about a number of problems. One, financing. If Utah requires sprinkling, which we believe we will, there

* See app. 1, p. 1663, for full statement.

will be considerable problem in the financing area. One means of finance is through the Small Business Administration, we believe this method is very important and will assist us.

We feel that there should be very definite guidelines on the use of combustible materials in construction and that the existing facilities be reviewed in this regard.

We second your proposal that there be a center for the study of materials. This should include not only construction materials but types of materials and solutions that are used in cleaning and other patient services with the hope we will find some means or substitutes that are less combustible or noninflammable to do the same job. Where we can not find these substitutes there should be rigid regulations on their storage and their availability to nonauthorized personnel.

Further, we recommend in existing facilities that solid core doors be the only doors adjacent to stair wells.

We also believe that the exit problem that was well covered by the fire professionals should be at opposite ends of the nursing units and not adjacent to one another.

We believe that there should be a thorough review of ventilation systems. This is a special problem in older homes which have been converted to nursing homes. The ventilation systems are the main reasons why doors are left open or propped open.

I was in a hotel in Seattle where they had a 2 by 4 propping open the fire door. Had there been a fire in the lobby of the hotel both major exits would have been blocked and the people would have had to jump. It is a problem in other facilities as well.

We also believe that a notifier system should be continued in those homes that presently have sprinkler systems. We believe that lives can be saved where rapid response is forthcoming. We are also concerned about the people on duty and believe that stipulations should be made that these people are on duty and not away from the nursing unit or otherwise occupied.

We also hope you will find some means of extending safety measures to the custodial or residential health care facilities. These are marginal facilities that are at a lower care level than the nursing home. They generally will have fewer fire control measures than the nursing homes including the intermediate care facilities. We are hopeful to include most of these facilities under our new program in Utah.

It is important to note that residential care facilities also contain people who are supported either directly or indirectly by Federal funds. Many of the people in residential facilities receive a grant and part of this grant is usually Federal.

I have some general recommendations that could assist us and probably help in the prevention of similar tragedies.

First, concerns nursing home inspections. We are hopeful that there would be 100 percent Federal funding of inspection units rather than relying on State matching. This is a particular problem in some of our smaller States where State funds are not readily available. These 100 percent funds should not be hamstrung by categories or anything of this nature. This will allow us to look at all facilities and not run the risk of an audit.

Concerning mentally disturbed patients we believe there is a sizable hazard with patients in all nursing facilities. These patients in

many cases are old, many of them have chronic brain syndrome and other mentally disturbed situations. There should be a support program for training of nursing home personnel to handle these types of patients. I also believe, pertaining to regulations at the Federal level, there should be some guidelines for activity programs in all nursing homes. Recreational and other activity programs usually lead to more alert patients. We will have a safety measure by improving the care.

We also are hopeful that there will be some increased administrative flexibility in Federal programs. Regional offices should be able to make recommendations so that programs may be changed, not only in safety but in activity areas as well.

We are hopeful that there will be some guidelines worked out perhaps by study, perhaps by a special commission for handling nursing home patients who are very elderly and frequently disturbed.

In many cases our nursing home personnel feel that they will be cited for abuse of patients if they discipline or control the patients. Many patients are in need of control. We rarely have abuse of patients, although we have complaints in this area. Much of it is the other way around. We need certain guidelines to protect nursing homes in this regard.

Cost of Sprinkler System May Close Some Homes

We are also hopeful that the Federal Government will see their way clear to allow us the use of empty rural hospital beds. In Utah we will need these beds because we believe our new sprinkling system will close a number of marginal nursing homes. These are facilities who will elect to close rather than sprinkle.

We have a sizable number of rural hospital beds that are empty and restricted in their use by Medicare which requires costly accounting; the placing of patients in a specific area makes it untenable to use the beds. We are hopeful that we can find our way clear to use these beds and get relief from this particular situation.

We are also hopeful that you will support nursing home administrator training programs which are operational. At the present time we have a number of excellent programs. In the West there is a particularly good program at the University of California, Los Angeles. This program embraces a system of 2 weeks on campus, a year's correspondence course, and 2 weeks back on campus at the end of the program. The main problem is cost. We believe, if it is at all possible, that these programs should be supported.

In these general recommendations, I hope they will insist in improving the safety and other factors of the aging in nursing homes and related facilities.

Thank you.

Senator Moss. We thank you, Dr. Walter. That is a very comprehensive and well thought out set of recommendations, and certainly something that will give us on the committee some basis of measuring what we might do from the Federal level to bring about some of the improvements and changes.

I have been cruising in that direction and one thing I recommend, as I said in my opening statement, is to insure that these people can, under title XVI, get the protections that those under titles XVIII and XIX have. We use those terms just because the funding comes in a

different section of the bill, and that loophole has to be closed, as you recommend here.

Your recommendations about the sprinkling, you feel that Utah is definitely going to go in its State Code to require sprinklers in long term care facilities.

Dr. WALTER. It is my impression it will probably be instituted tomorrow.

Senator Moss. Well, hopefully, because I am sure it is your opinion as it was the other witnesses, that sprinkling in this case probably would have saved the lives of these people. And the fact that it is going to be an economic adjustment and cause some changes in operation of homes is little enough to pay to save a few lives, isn't it?

Mr. WALTER. That is correct.

Senator Moss. Is your understanding the same as the other witnesses, that these people died from carbon monoxide poisoning?

Dr. WALTER. Dr. Weston, our State medical examiner who examined the victims, reported death by carbon monoxide poisoning.

Senator Moss. I see. And this is a rather common cause of death from fires, isn't it?

Dr. WALTER. That is correct. There was one death, as you know, from jumping.

Senator Moss. Jumping out the window, yes.

Dr. WALTER. That is correct.

Senator Moss. Now in your recommendation about the floor supervision, and pointing back to this particular incident, there was only one person there other than those who were patients or tenants of the home. Is that adequate in your judgment?

Dr. WALTER. This is one of our problems. Our rules and regulations require, for that number of patients, only one person is required on that particular shift. We are particularly concerned with the problem of two story dwellings and would like to recommend that there would be an individual on both floors. Since this is an untenable situation economically, we believe that it is better for a facility of this type to sprinkle. This approach, which we could use, would bring about sprinkling as well, although I believe that these facilities will be sprinkling under a direct regulation.

Senator Moss. How often are homes of this sort inspected by the Department of Health?

YEARLY INSPECTION OF HOMES

Dr. WALTER. They have to be inspected yearly. Many are inspected at various times depending on problems, complaints, and so forth. We have had a very limited staff of two people for 136 nursing homes, 42 hospitals, and a number of other types of facilities so inspections have been limited but they must be inspected once a year. In this particular case, two members of the Salt Lake County organization were inspecting this particular organization.

Senator Moss. Is the inspection incident to renewal of the annual license?

Dr. WALTER. That is right.

Senator Moss. If the personnel were available, would you institute a more frequent inspection than just annually?

Dr. WALTER. By all means.

Senator Moss. Well, we always bump up against the problems of finances and manpower.

On the ventilation recommendations, you recommend something—What would be practical on that? Would it be some forced air ventilation or what do you have in mind?

Dr. WALTER. We would hope that there at least would be adequate windows and so forth. However, the forced air type ventilation would be perhaps the way out in this particular situation. In this case they were using the halls and the open doors for ventilation. This problem could be improved in older facilities by certain changes. Each ventilation system would have to be customized, however, to that facility. The new homes in general are adequately ventilated.

Senator Moss. This nursing home had an air-cooling unit in the window. I saw the picture of that. If this was in warm weather, would those others who wanted to get cooling from that unit leave their doors open?

Dr. WALTER. That is correct.

Senator Moss. Well, we do appreciate your coming here, and your recommendations, as I say, are excellent and I find that I am in agreement with them. Certainly we have to move farther along and provide more adequate protection for our elderly people who live in these facilities, and not only the elderly people but wherever we have any kind of federally assisted institutional venture we should have adequate protections for all people. I am glad that the health department and the fire marshal and others are very actively moving to improve the State regulation. We ought to have Federal regulations that complement and strengthen the State in its endeavor to bring safety to these people.

Thank you very much, Dr. Walter.

Dr. WALTER. Thank you.

Senator Moss. Mr. A. E. Willey, National Fire Protection Association, and Dr. Richard E. Stevens, director of engineers, National Fire Protection Association.

Would you two gentlemen come forward, please.

We are very pleased to have you, gentlemen. You may proceed. You each have a statement, so Mr. Willey, will you go first, please.

STATEMENT OF A. ELWOOD WILLEY, FIRE RECORD DEPARTMENT, NATIONAL FIRE PROTECTION ASSOCIATION, BOSTON, MASS.

Mr. WILLEY. Thank you, Senator Moss.

To preface my comments, I would like to acknowledge the very fine presentations by the local and State officials involved in this particular fire incident. I believe that the detail that they have provided complements our statements that will follow. My statement particularly will highlight some of the pertinent circumstances involved in the loss of life in this facility.

Senator Moss. Very good.

Mr. WILLEY. The tragic results of the recent Lil-Haven Nursing Home fire in Salt Lake City is not new to the fire protection profession. In fact, the NFPA has continued to document similar multiple death nursing home fires over the years. A review of these losses has led to the conclusion that the time between fire ignition and evacuation is a most critical factor. It is evident that we must provide fixed pro-

tection systems and appropriate construction features to buy sufficient time for the safety of the elderly and infirm, often incapable of self-preservation, who occupy our nursing homes.

Limitations of Fire Detecting Equipment

The Lil-Haven Nursing Home fire carries a very important lesson by demonstrating the limitations of protection provided by automatic fire detection and manual firefighting in nursing homes of combustible construction. Even with an automatic fire detection system which was arranged to send an alarm signal to the fire department, and with an unusually rapid and efficient response from the fire department, there was not sufficient time for six ambulatory patients either to escape or be rescued by others. The pertinent circumstances responsible for loss of life in this fire were developed during the NFPA investigation, conducted with the cooperation of Fire Marshal Andrus of Salt Lake City, and Utah State Fire Marshal Tanner.

The structure was originally converted to a nursing facility from a residence, and had operated under previous management as the Utah State Miners Hospital. The two-story, 35- x 50-foot building was of mixed wood frame and brick veneer construction. The building was sited on a sloping grade so that exits from each story led approximately to grade level. A single unenclosed stair provided access between the first and second floor. A substandard wood door was provided at the top of the stairs, and the installation did not include an approved self closer.

Prior to the fire, as it is so common, this door was blocked open thus allowing toxic products of combustion and fire to communicate to the second floor. The second floor was served by a single exit discharging from a sleeping room across a ramp to grade outside. The open stair could not be considered an exit as it was not remote, and did not discharge directly outside the building.

Interior finish in the home was originally wood lath and plaster with subsequent application of paint and paper. Combustible finish materials were applied over the plaster which provided fuel for rapid flame spread through the corridors. A particle board wainscot had been added to first floor corridors.

Carpeting had been added to a portion of the first floor corridor and to the stairs. Combustible ceiling tile was installed in the second floor corridor and two of the second floor sleeping rooms. Furnishings in the facility provided fuel for the fire including: mattresses and bedding in the room of origin, and a stuffed chair and contents of a clothes locker in the first floor corridor.

The facility was provided with a combination rate of rise/fixed temperature automatic fire detection system, which was approved by the fire department. This system provided complete coverage of detectors throughout all rooms and spaces of the building. The system was arranged to sound local evacuation bells and automatically transmit a signal to the fire department. Automatic sprinkler protection to detect and control a fire was not provided in the facility. Emergency illumination for the means of the egress was also not provided.

The night of the fire 17 patients occupied the 19-bed facility and were attended by one staff member. The facility design problems discussed above and the stairway door blocked in an open position com-

bined to expose these 17 aged and infirm patients to disaster. The fire was allegedly set by a 93-year-old man using a combustible liquid, mineral oil, with a 210° flashpoint. A total of 1 gallon of the liquid was spread on a portion of the carpeted stairs, in the corridor, and in his first-floor room adjacent to the stairs. This room was also occupied by another patient who was in his bed at the time. The 93-year-old man apparently ignited the mineral oil and furnishings in the room.

The detection system operated sounding the alarm bells and sending a signal to the fire department. Fire department response was very rapid. The battalion chief was on the road returning from a previous alarm and was approximately eight-tenths of a mile away from the building. He arrived within 1 minute of the alarm transmission from headquarters. The first-due engine company, quartered approximately seven-tenths of a mile from the home, arrived 1 minute later.

Meanwhile, the attendant heard the local alarm bells and rushed up to the main floor from a basement staff sleeping room. Fire was involving the room of origin and the two patients were in the doorway. The attendant assisted both men away from the room, down the corridor, and was able to get one man outside. Arriving firefighters were then able to rescue the remaining five patients and the fire-setter from the first floor.

The second floor situation was, however, much more critical. One patient was awake when the fire alarm bells sounded. He attempted to wake two other patients in his room. He then proceeded down the second floor corridor toward the stair. He could see smoke and fire burning in the stairway; moments later the corridor was probably untenable due to smoke and heat. He then proceeded to another sleeping room waking two more patients and exited through the exit door from the room to the ramp outside. The two patients in that room were able to escape through the same door.

Two other patients on the second floor also escaped. One jumped from a window in his room receiving serious injuries. Another jumped from the same room but later died. The third patient of the same room waited at the window and was rescued by fire fighters.

The five remaining patients in two rooms died as toxic products of combustion filled their rooms from the uncontrolled fire that moved up the stairway and down the corridor. Doors to both of these rooms were closed. The smoke patterns were obvious in these rooms with some heat damage, and no fire damage was evident.

Fire Spread Rapidly

The rapid spread of fire was documented by the direct alarm connection to the fire department and observation of witnesses. The alarm system performed its function properly, the signal was received at fire alarm headquarters, and responding fire companies were notified at 12:41 a.m. That battalion chief was at the scene within 1 minute from the start of the dispatching procedure. As he pulled up to the nursing home, he could see the glow of fire at the rear of the building. As he moved to the rear of the building, he observed fire rolling from two windows in the stairway.

Fire involved the stairway approximately 2 minutes after the detection system activated to sound the alarm. The first due fire company arrived on the scene 1 minute behind the battalion chief, and

rescue operations were begun within approximately 3 minutes after activation of the alarm system. In would be difficult to imagine a more efficient response by a professional full-time fire department. Yet, only one patient was rescued from the second floor by firefighters. The combination of circumstances responsible for the spread of the uncontrolled fire provided far too little time to rescue any of the five fire victims trapped on the second floor.

In conclusion, this fire tends to illustrate the inadequacy of total reliance on automatic fire detection sytsems and manual firefighting to insure reasonable life safety in nursing homes of combustible construction. The State of Utah fire protection requirements allowed exceptions from sprinkler protection requirements. In this facility sprinklers were not required, as an on-duty fire department was available within 3 miles and an approved fire detection system was installed with direct alarm connection to the fire department.

In my opinion, these deaths at the Lil-Haven Nursing Home would not have occurred if automatic sprinkler protection had been provided. Of course the stairs should have been properly closed, and of course the flame spread of the interior finish should have been reduced. These fire protection measures are elements of the system to provide reasonable nursing home life safety as contained in the NFPA 101, Life Safety Code.

That concludes my prepared statement, Senator Moss.

Senator Moss. Thank you, Mr. Willey. That is a very fine summary and detailed statement of events, and what the causes and results were in the fire.

If I have any questions I will postpone them until we have heard from Dr. Stevens, and then I may have questions of either one of you.

Will you go ahead, please, Dr. Stevens.

STATEMENT OF RICHARD E. STEVENS, DIRECTOR OF ENGINEERING SERVICES, NATIONAL FIRE PROTECTION ASSOCIATION, BOSTON, MASS.

Mr. STEVENS. It was on February 9, 1970, that I last appeared before this subcommittee to plead a case for our elder citizens confined to nursing homes, convalescent homes, homes for the aged or by whatever name places are called where the elderly are housed and cared for because they are not able to care for themselves. That appearance was prompted by the tragic occurrence on January 9, 1970, in Marietta, Ohio, where 31 elderly persons died in a fire at Harmar House Convalescent Home. Prior to my appearance before you in 1970, I made a presentation in which many fatal fires in these occupancies were cited as a graphic example of the unconscionable fire record in these occupancies.

Now I appear before you again in the aftermath of a tragedy to plead a case for the elderly. This most recent case involving the Lil-Haven Nursing Home in Salt Lake City did not present any new lessons. One wonders how many tragedies it will take before positive, reasonable action is taken to protect our elderly. I stress reasonable because frequently under duress in the wake of a fatal occurrence, legislation is passed which is unduly restrictive and beyond what is considered to provide a reasonable degree of life safety from fire.

You, Senator Moss, through your contribution to Public Law 90–248, have done a great service to the elderly of this Nation by making it mandatory that nursing homes receiving Medicaid benefits comply with the provisions of the Life Safety Code of the National Fire Protection Association.

If the Lil-Haven Nursing Home in Salt Lake City had complied with the provisions of the Life Safety Code, that tragedy being discussed here today would not have occurred. By utilizing the Life Safety Code, a reasonable degree of life safety from fire is assured. In support of this statement, I point out that the text of the code pertaining to the type of occupancies under discussion here is prepared by a committee comprised of representatives of the American Institute of Architect, the American Nursing Home Association, the American Hospital Association, the Fire Marshals Association of North America, the U.S. Department of Health, Education, and Welfare, the U.S. Veterans Administration, the U.S. Bureau of Standards and the American College of Surgeons.

The text is then reviewed by a committee of much broader representation but balanced by representation such that no one interest can dominate the committee action. After committee approval, the proposed code text is published by the National Fire Protection Association for public review prior to final action by the association at its annual meeting. At the annual meeting anyone may propose amendments, referral, adoption or rejection of the proposed code text and the association acts on the motion after free and open discussion. The association action is final. This brief description of the standards making system of the National Fire Protection Association describes a system that has been judged by the American National Standards Institute and the U.S. Department of Labor as one which results in the production of consensus standards.

Not only does the code provide a reasonable degree of life safety from fire, it also provides for cases where there may be a practical difficulty or a severe hardship in complying with the code provisions, as pointed out by you, Senator Moss, in your statement to Congress as recorded in the March 21, 1971, Congressional Record.

Extend Life Safety Code to All Facilities

I now urge you to introduce legislation which would extend the application of the Life Safety Code to all occupancies which provide for the care and housing of the elderly whether they be known as nursing homes, convalescent homes, homes for the aged or by any other name. I urge this legislation because, as I have stated here on numerous occasions, the fire safety problem of the elderly is unique. It is unique because the patient himself is generally incapable of any act of self-preservation in an emergency situation due either to his own mental or physical infirmities or to conditions which are forced upon him.

Since this subcommittee is concerned with aging, and more specifically long-term care, I doubt that the subcommittee cares whether the structure in which the aging are housed is called a nursing home, convalescent home or home for the aged. The problem is the aged and the regulations should apply to all facilities for the care of them.

As was pointed out earlier in this statement, the lessons from the fatal fire at the Lil-Haven Nursing Home are not new. The fire was allegedly set by one of the patients. This is one of the characteristics of the patients in these occupancies that makes the fire problem in them unique. As I stated in my testimony before this subcommittee on February 9, 1970, since many of the patients do not possess the mental abilities that they once enjoyed, they are apt to be the originators of fires through overt acts.

The nursing home was a converted dwelling probably typical of hundreds of similar homes. By the standards of the Life Safety Code the exits were inadequate, protection was inadequate because there was no automatic sprinkler system, the flame spread rating of the interior finish was too high, the single stairway was not adequately enclosed and there was no emergency lighting. There is hardly ever a single factor to which loss of life from fire can be attributed and, therefore, there is no single device or system which can prevent loss of life from fire. This is why the Life Safety Code deals with many features so that a system for life safety can be provided with adequate safeguards to assure the continuance of the system if any one feature of it should fail during a fire emergency.

I point out during today's discussion one feature that quite commonly prevails is the door that is propped open, and therefore we must provide an alternate route.

Briefly, this nursing home fire is one more case to add to a long list of tragic examples of our failure to apply proven answers to existing problems.

In conclusion, the Senate Special Committee on Aging and this Subcommittee on Long-Term Care is most certainly concerned with the fire safety of the elderly and progress has been made. Unfortunately, however, there are still many buildings in the United States in which the elderly are housed and cared for which do not provide even a reasonable degree of life safety from fire. Many such properties take certain measures to provide the appearance of fire safety, particularly those measures involving the least possible cost, but these are often little more than empty gestures, and when fire does strike, people die. It is not enough to investigate each multiple death fire in an effort to seek out the problems and place the blame.

Three Recommendations

For example, the newspaper carried the story charging a 93-year-old patient of the Lil-Haven Nursing Home with homicide. The problems are obvious and so are the answers.

I have three recommendations:

1. There must be reasonable standards of fire safety promulgated.
2. There must be assistance provided to assure enforcement and compliance with those standards, and
3. The standards must apply to all buildings where housing and care is provided for the elderly.

So long as society is prepared to tolerate the conditions which are well known to place lives in jeopardy from fire, just so long will we continue to face needless tragedies like the one under discussion. In

respect to facilities for the care of the aged, perhaps you will agree with me that the time has finally come to call a halt.

Thank you, Senator.

Senator Moss. Well, thank you very much, Dr. Stevens. You have indeed been before our committee many times calling attention to some of the needs of the elderly. We welcome your recommendations now.

Your recommendations are somewhat similar to Dr. Walter's. You heard him make his recommendations. I assume you approved of the things he said.

Mr. STEVENS. Indeed I do, Senator.

Senator Moss. I think it is fairly clear that we certainly do need to upgrade the fire safety requirements that we have and as you say, to enforce them, with proper manpower and insisting on full compliance.

Sometimes we have sort of token compliance that occurs in the absence of adequate enforcement. This is a problem in some of our smaller States. Manpower and money is the crux of the problem, but since the Federal Government is involved to the extent we are, the Government ought to come forward with the sufficient financial support and reinforcement so that these improvements can be accomplished to enable us to assure safety for our elderly citizens.

You saw the demonstration of the pill test on the carpet.

Do you have any comments on the pill test? Is it as unpalatable to you as it seems to be to us on the committee?

Mr. STEVENS. I do not feel that the pill test adequately simulates the actual condition to which the carpet may be exposed, and therefore I feel the results are of limited usefulness.

Senator Moss. The same pattern occurs over and over, furnishings within the building very often are the fuel for the fire; in this case it was certainly helped along by that flammable oil.

This fire obviously was a very hot one. I went through the building and saw many plastics that had melted, they just dropped there like wax off of a candle. Yet as was testified here, a towel hanging on a rack was not consumed, it was not charred, just a little smoky. So this was a very intense flash fire, obviously.

The principal problem, and you and all of the witnesses have touched again and again is that the elderly people being handicapped can't move about the way others can and many times they have mental disorientation or difficulties. I guess the practice is not uncommon for a good deal of sedation to be given elderly people so they can sleep at night. So they do pose a particular problem for us and one that we have to deal with.

I certainly accept your recommendations and in fact I have already come to some preliminary conclusions of my own. We certainly have to have more rigorous enforcement as you have indicated.

I am very pleased with our witnesses who came from Utah to find out how the State and the city are now moving up in their efforts to improve the code and enforce requirements which will improve the safety for our infirm elderly.

I was asking those questions about how often the inspections were made and whether they could be stepped up. I agree that we need an amendment to the Social Security law similar to the amendments I introduced first to Medicaid and then asked to be extended to Medi-

care. I believe the Life Safety Code should apply to all classes of facilities where elderly people are cared for and the fact that there are intermediate care facilities that fall under title XVI is no reason for an exclusion. This legislation I say again will, because I am convinced conformance with the Life Safety Code ought to be required of any facility where elderly people are housed, and where Federal funding is involved.

Federal Aid

Again, in accordance with your recommendation I think we ought to have some means of financially helping the conversion along. One answer is my new proposed bill, the Fire Safety Equipment Enabling Act to provide some Federal funding to help States and the nursing homes purchase sprinklers and other fire equipment.

We have dodged that sprinkler issue for a long time because of the fears of many that the nursing homes would have to be closed down principally in rural States and smaller jurisdictions, I think we cannot dodge the question any longer. We are going to have to require sprinklers, and in order to require them we should have some backup to help the nursing homes meet the costs.

Dr. Walter, suggested we ought to make hospital beds available in some of our rural hospitals which would be all right for a stop-gap measure, but it would be just temporary until we could get adequate facilities constructed with sprinklers in them because we can't take up acute hospital bed indefinitely with people who are not in need of acute care.

I think we need increased funding for the Fire Research and Safety Act so that we can learn more about what happens during the course of a major fire. As I indicated, I think that the very fine facility we have at the University of Utah might be a good spot to do that. We already have in place a lot of equipment and personnel and expertise that we need. We need to know more about it and then I think we need to give greater attention to our flammable fabrics and our carpet standards and other equipment that we have in the nursing homes so that we can reduce flammability with safety without causing additional CO (carbon monoxide). That was an interesting factor that came out, it seemed to me, from the testimony of Dr. Einhorn, that sometimes by retarding the combustibility you increase the amount of CO rather than CO_2 and add to the toxicity—it's the CO that kills most of those in institutional fires.

So I think there is a great deal to be learned about this question and we certainly have learned that we have not quite measured up yet in our efforts to improve protections for our elderly citizens.

I am most grateful to you gentlemen and to the other witnesses who have come to build this record which will enable me then to go to the rest of the committee and the Senate and see if we cannot make improvements from the Federal level and help our States, cities, and communities to upgrade their requirements on inspection and enforcement in the furnishing of nursing homes.

I have five recommendations for action and, without objection, will place them in the hearing record.

(The recommendations follow:)

RECOMMENDATIONS FOR ACTION

1. More rigorous enforcement of State and Local fire codes by State Fire Departments.
2. Amending the present Social Security law so that the 1967 Moss amendments which cover Title 19 (Medicaid) nursing homes and Title 18 (Medicare) nursing homes will be made applicable to the new class of nursing homes called Intermediate Care Facilities (Title 16). All three categories of nursing facilities paid for in part by Federal funds would then have to be in conformity with the Life Safety Code of the National Fire Protection Association.
3. The enactment of a new Moss bill (in preparation)—*The Fire Safety Equipment Enabling Act* to provide Federal grants and loans to help States and nursing homes pick up part of the cost of sprinklers and other fire safety equipment.
4. Increased funding for the Fire Research and Safety Act of 1968 so that we can learn more about what happens during the course of a major fire and perhaps prevent similar occurrences.
5. Greater attention within the Government to the subject of Flammable Fabrics and carpet standards in particular. Reasonable standards are needed to protect individuals. Nursing homes and hospitals which house those who are not ambulatory need higher standards. These standards must come soon.

Do you have anything, John Guy? Val?

Mr. MILLER. No.

Mr. HALAMANDARIS. No.

Senator MOSS. Well, thank you very much, gentlemen. Thank all of you. I do appreciate it. I think it was a very fine hearing.

We stand in recess.

(Whereupon, at 12:02 p.m. the subcommittee was recessed subject to call of the Chair.)

APPENDIXES

Appendix 1

ADDITIONAL MATERIAL SUBMITTED BY WITNESSES

ITEM 1. PREPARED STATEMENT BY BRUCE A. WALTER, M.D., M.P.H., DEPUTY DIRECTOR OF HEALTH, UTAH STATE DIVISION OF HEALTH

Gentlemen: Thank you for the opportunity to express my views of the Lil-Haven Nursing Home tragedy; a tragedy that could be repeated to some degree in other facilities in any of the states or territories. In the State of Utah, as in others, we have episodes of a similar nature which are limited in various ways, result in minimal facility damage, and cause no injuries or deaths, and thus go unrecorded in the news media. As I see it, our effort to handle *ALL* possible facets of the problem is tenable, including: (1) the prevention of episodes from occurring; (2) the minimizing of those that are brought about so damage is limited; and (3) most important, the elements that lead to elimination of injuries and loss of life.

The Lil-Haven tragedy has a number of pertinent features which should be considered, and may be listed as follows:

1. Limited floor supervision at night after normal working hours;
2. Limited medical and nursing surveillance of specific patients who could have the capability of affecting the safety and health of all patients;
3. The availability of substances which support or enhance combustion;
4. Combustible construction materials that were utilized on the walls, ceilings, and floors which could have been substituted with non-combustible materials;
5. A *less* than adequate ventilation system on the second floor which led to the patients' propping open the normally closed fire door with a fire extinguisher;
6. Doors adjacent to the stairwell were residential type and not of solid core.
7. The alternate fire exit on the second floor was located adjacent to the potentially vulnerable stair well instead of at the opposite end of the floor;
8. No sprinkler system of any type was present in the building, but there was a functioning detector and alarm system. The alarm (bell) audio system should have been detectable outside the building in addition to internal sounding;
9. The exceedingly rapid response of the fire department representation at the scene, probably within one minute, was not soon enough to save all of the lives because of the nature of the fire, construction of the building and other exigencies;
10. The Salt Lake County disaster plan, which includes a two-way radio program, brought an ambulance response in four minutes and response of seven emergency vehicles within twelve minutes;
11. The facility in question was exempted by "Grandfather" clauses which did not require the nursing home to meet the requirements specified for new construction;
12. It is ironic that the present condition of the building and the extensive restorative repair necessary to facilitate reopening will require installation of an approved sprinkling system.

The specific data relating to the structural materials and the tragedy have been covered by other testimony. The above points suggest a number of avenues of positive action that might help in preventing or reducing the possibility of repetition of this tragedy in other health facilities. Points to be considered are as follows:

1. Development of a life safety code that includes complete approved sprinkler systems in all nursing homes which are constructed of combustible materials, with the consideration of applying this to all nursing homes, regardless of type of construction;

2. Rigid enforcement (backed by penalties) of restrictions on the use of inflammable construction materials, including wall, ceiling, and floor coverings. This would include new construction, remodeling, existing structures, and existing materials that are present.

3. A study of all substances used in health facilities for cleaning, maintenance, and other servicing of patient areas with the view of replacing this material and solutions within a specified interval with suitable non-inflammable substitutes, thereby reducing the presence of potential problems. This study, where successful, should be followed by specific restrictions on use of inflammable materials for services where other non-inflammable substitutes are available.

4. All inflammable solutions or other materials that must be used because of the lack of substitutes should be required to be stored under proper security measures, out of reach of patients and other non-authorized personnel. The definition of "inflammable" must be extended to all substances which could substantially support combustion, either by a specific flash point or other equivalent rating.

5. All existing, as well as new, construction of multi-story nursing facilities must have solid core or fire resistant doors adjacent to stair wells. Acceptable substitutes with the same or superior fire rating would be acceptable.

6. All existing, as well as new, construction should have the required two exits; a minimum of one at opposite ends of the nursing unit. The exists must provide an unobstructed means of evacuation appropriate to the type of patients and their physical and mental condition.

7. Nursing home to fire department notifier systems should be required in all areas where feasible. Certain outlying areas might be exempt upon a review by the Fire Marshal, preferably the State Fire Marshal.

8. Nursing personnel in suitable numbers must be in a duty status in the nursing unit at all times, dependent upon the number and type of patients and the construction of the facility.

9. Residential health care facilities or other custodial health facilities which are not specifically classified as nursing homes should be reviewed, and if found to have conditions that might be unsafe, should be included under the new regulations where possible. Persons receiving care in these types of facilities are usually private or may be on state assistance grants assisted by federal funds.

The following are recommendations relating to general program problems in contrast to specific points relating to the tragedy. These proposals may also contribute to the general safety of all patients to a greater or lesser degree:

1. *Nursing Home Inspections.*—Many of the safety problems could be solved or improved if sufficient numbers of inspection personnel were available. Until recently, only title XVIII provided complete support for Medicare extended care facilities review. These have now declined in number, leaving the under-funded and under-manned state licensure units to inspect these and all title XIX, intermediate care (both levels) and residential health care (custodial) facilities. Inspection units must rely on state matching funds and thus are limited.

My recommendation is that there be made available 100% federal funding for the support of all inspections of all health facilities. These funds should not be limited by categorical programs in order to facilitate freedom of use of personnel without the fear of audit exceptions. These should be consolidated in the state health departments to reduce fragmentation.

2. *The Care of the Mentally Disturbed Patient.*—Nursing homes and related facilities care for a substantial number of patients with varying degrees and many types of mental disorders. Patients with these disorders are frequently more disturbed at night due to physiologic, emotional, and drug factors.

I recommend that a prototype program be developed with suitable written and other materials for the purpose of instructing nursing home personnel on the supportive care of the disturbed patient.

3. *Activity Programs for Nursing Home Patients.*—One way of assisting patients mentally disturbed or others is to involve them in a meaningful and acceptable activity program. This type of program may alleviate some of the depression of the patients, improve their mental outlook, cooperation and response to rehabilitation or other training programs (such as bowel and bladder and incontinence). An active program might reduce paranoid and depressive reactions, thereby improving safety as well as patient care.

I would recommend that regulations should specify that certain activity programs be instituted and where feasible, recreational therapists be employed as consultants, or full time if warranted by the size of the facility.

4. *Administrative Flexibility in Federal Programs.*—Present rigid restrictions on reimbursement and fiscal accounting procedures may well be hampering the provision of safety measures and training of personnel to review and inspect facilities. Reimbursement for all federal programs must be reasonable in all respects.

I recommend that greater administrative latitude with suitable supervision be granted HEW regional offices to work out programs suitable to the area which will improve and facilitate reimbursement for safety and other needed changes.

5. *Guidelines for Handling Nursing Home Patients.*—Nursing homes receive some unwarranted comments concerning their handling of patients. Rarely do we find major abuse of patients. More commonly patients become very difficult to handle and may abuse the nursing personnel. Because of the fear of public indignation, many patients are not adequately controlled.

I suggest that recommendations be drawn up concerning this problem. The guidelines for patient control and discipline would serve as instruction of nursing home personnel as well as an answer to public comments. Disciplinary action is necessary under some conditions. There are many ways of controlling difficult patients, most of which are classified as restrictions. This code, though difficult to develop, could help in many ways.

6. *Flexibility of the Use of Hospital Beds.*—The invoking of new regulations may reduce the number of available nursing home beds in some areas. In rural areas, where hospitals frequently have low occupancy, traditionally empty beds could be more effectively used. By appropriate administration, such use will not only increase the efficiencies of these hospitals, but will tend to lower the level of costs for hospital patients as well. Because of the nature and limited administrative levels of small hospitals, comprehensive cost accounting and rigid distinct parts are at best inappropriate.

I recommend that empty beds be appropriately used, the restrictive placement of patients and the untenable cost accounting requirement be waived or be developed as an experimental project under the 1967 Medicare Amendments. Suitable reimbursement mechanisms are available to insure cost controls and savings to all concerned.

7. *Support for Training Courses for Nursing Home Administrators.*—A number of excellent courses for nursing home administrators exist in the country. The primary problem is cost.

I recommend that suitable educational funds be directed to these courses so that nursing home administrators may be trained in administration, patient care, activities, safety, and other areas for more economical and higher quality patient services.

ITEM 2. PREPARED STATEMENT BY IRVING N. EINHORN, RESEARCH PROFESSOR OF MATERIALS SCIENCE AND ENGINEERING; ADJUNCT PROFESSOR OF CHEMICAL ENGINEERING; DIRECTOR, FLAMMABILITY RESEARCH CENTER, UNIVERSITY OF UTAH, SALT LAKE CITY, UTAH

COMBUSTION OF POLYMERIC MATERIALS AND THE PHYSIOLOGICAL AND TOXICOLOGICAL ASPECTS OF FLAMMABILITY

1. INTRODUCTION

Recent reviews of fire statistics[1,2,3] indicate that approximately 2.5 million fires occur in the United States annually, causing a property damage loss of $2,447,600,000 during 1969. The number of fires increased 2.6 per cent from 1968 while the amount of loss increased 8.5 per cent.

Because of persistent inflation, the number of fires per thousand population is a more reliable measure of fire prevention than is the figure for dollar loss. Table I presents a summary of the number of fires that occurred each year from 1960 through 1969 based on population.

TABLE I

ANNUAL FIRE STATISTICS (BASED ON POPULATION)

Year	Fires Per 1,000 Population	Estimated Yearly Fire Losses
1960	11.8	$1,106,824,000
1961	12.0	1,209,042,000
1962	12.2	1,265,002,000
1963	13.1	1,405,558,000
1964	12.4	1,367,128,000
1965	12.1	1,455,631,000
1966	12.2	1,469,755,000
1967	12.1	1,829,920,000
1968	11.8	1,952,622,000
1969	12.0	2,447,600,000

During the 1960's there was little change in the number of fires per thousand population. Table II[3] presents a comparison between the percentage distribution of the chief fire causes in 1969 as compared with 1959, based on the number of fires.

TABLE II

TRENDS IN FIRE CAUSES

Cause	1959	1969	Trend
Heating and Cooking	22.9%	14.4%	Substantial reduction
Smoking and Matches	18.0	11.5	Substantial reduction
Electrical	13.9	14.0	
Flammable Liquids	6.5	4.8	
Open Flames and Sparks	6.0	6.2	
Lightning	3.3	2.3	
Children and Matches	3.9	8.2	Substantial increase
Exposure	2.8	1.9	
Incendiary or Suspicious	2.3	5.8	Substantial increase
Spontaneous Ignition	2.6	1.9	
Miscellaneous Known	11.3	12.1	
Unknown or Undetermined	6.5	16.9	Substantial increase
Totals	100.0%	100.0%	

The major areas of fire losses are:

Clothing and Apparel Fires
Interior Furnishings (e.g., carpets, mattresses, wall coverings)
Fires in Homes, Multi-Resident Dwellings, Institutions, and Public Buildings
Transportation-Associated Fires

A. Clothing and Wearing Apparel

More than 13,000 people die each year in the United States from fire exposure, with an additional 2,000,000 people suffering burn injury. Approximately 6,000 deaths, or almost one-half of the total fatalities due to fire and explosion, occur each year as a result of fabric fires. Schaplowsky[4] reported on approximately 300 cases involving flammable fabrics. Samples of the fabrics involved in about one-third of these cases were subjected to flammability tests specified by existing standards. All clothing items tested passed these standards, indicating that much more work is necessary to adopt more reliable standards. Table III summarizes the distribution of garments involved in this case study.

The types of fiber in the clothing that ignited, with resulting burns, were: cotton, 87%; nylon, 7%; wool, 2%; cotton and dacron combinations, 2%; and "synthetic" not otherwise classified, 3%.

A study of the ignition causes revealed the source of ignition in 29% of the cases to be matches or cigarettes; gas stoves, 11%, incinerators, 9%; followed by electric stoves, trash fires, fireplaces and barbecues, water heaters, electrical sources, and furnaces (each at 4 to 6%).

More than 2 million burn victims in the United States each year require restriction of activity for a day or more, or medical attention. About 85 percent of those persons involved in fire received medical attention, with approximately 300,000 cases involving disability requiring confinement to bed.

Cost of medical care of burn patients may run to more than $150.00 per day with the length of hospitalization often extending to periods as long as four months for elderly victims. It is estimated that in excess of 400 million dollars annual losses are incurred as a result of fabric burns and

TABLE III

ANALYSIS OF CLOTHING FIRES
(300 case histories — 1968)

Burn Cases Involving Males - Adults	
Garment Involved	Percent
Shirts	45
Trousers	26
Miscellaneous	29
Burn Cases Involving Females - Adults	
Garment Involved	Percent
Nightwear	41
Sweaters	17
Blouses	15
Bathrobes	11
Miscellaneous	16
Burn Cases Involving Children	
Garment Involved	Percent
Nightclothes	40
Shirts or Blouses	35
Miscellaneous	25

Data from reference[4].

this figure does not include return hospital visits, drugs, property and community losses or other losses for which no data are now available.

B. Interior Furnishings

1. Floor Coverings

Until recent years little consideration has been given to carpeting and other types of floor coverings by fire marshals, fire protection engineers, and building officials. Several reasons are obvious for the lack of concern in the past; these include the fact that until recent years most carpets were constructed of wool fibers, a naturally fire-resistant material; secondly, considering that hot gases caused by a fire tend to rise, ceilings and upper sidewalls are subject to more severe exposure than floors. For this reason, flame spread limitations were customarily applied only to wall and ceiling finishes. The United States Public Health Service through its Division of Hospital and Medical Facilities has established a tentative flame spread limit of 75 for carpeting and other floor covering materials used in patient-occupied areas and exitways in hospitals receiving aid under the Hill-Burton Act.

Controversy has existed for a number of years as to the proper test procedure that should be specified so as to provide a realistic evaluation of hazards encountered during fire exposure of floor coverings. The ASTM-E-84 Tunnel Test, a large scale test, has been used to evaluate materials used in building applications. This most useful test can relate the flame propagation, fuel contributed, and smoke density characteristics of ceiling materials since the test specimens are held in a horizontal position above the flame source. Questionable relationships to real hazards are obtained when samples are supported in a vertical position or placed on the floor of the tunnel. Initially

carpets were suspended from the top of the chamber, while held in place by a wire. In the author's opinion, this does not represent a realistic evaluation of floor covering materials. Table IV[6] illustrates the typical response obtained when floor coverings are exposed to the flame source while positioned on the tunnel floor.

Several recent literature references discuss fires in buildings which involved carpets. A home fire in Compton, California[6] involved a 100% high pile acrylic carpet. The owner watched a spark or burning brand from the fireplace ignite the carpet, but because of the rapid flame propagation, was unable to extinguish or control the fire. Extensive damage was caused to the home interior before the fire was finally controlled by local firefighters.

A serious carpet fire,[7] involving 84 linear feet of polypropylene carpeting, short pile fiber on a foam rubber pad with burlap backing, in the Imperial Apartments, Nashville, Tennessee, resulted in the death of an elderly woman. Several other people located in the building at the time of the conflagration were hospitalized due to smoke inhalation. The cause of death was due to carbon monoxide poisoning with synergistic effects resulting from the accompanying high temperatures.

Similar fires have been reported for many other types of carpeting. In many instances the occupants discover the fire during the early controllable stage, but because of the high heat generated, together with copious amounts of thick black smoke, and the rapid propagating nature of the carpet, substantial property loss occurs.

A major fire occurred in the Harmar House Nursing Home in Marietta, Ohio early in 1970. This fire was reported to have started by careless ignition of paper in an injection molded polypropylene wastebasket. The

TABLE IV[5]

FLAMMABILITY CHARACTERISTICS OF FLOOR COVERINGS
ASTM-E-84 TUNNEL TEST*

Test Specimen	Flame Spread	Fuel Contributed	Smoke Density
Red oak flooring	91	68	210
Sheet vinyl flooring	3	10	6
Vinyl asbestos tile	3	4	22
FR insulation board	96	81	0
Wool carpet	3	18	8
Acrylic carpet	39	14	83
Nylon carpet	130	56	219
Wool and hair pad	113	71	252
Hair pad only	3	12	12
Acrylic	200	52	240

*Samples floor mounted.

burning olefinic polymer melted and ignited the underlying nylon carpeting. Once the fire penetrated the carpeting to the underlay, a styrene-butadiene copolymer, dense black smoke was emitted which rapidly obscured vision. Twenty-two lives were lost in this tragic, but avoidable, fire.

As in many other types of fires, attention is directed toward ignition and flame propagation characteristics of materials with little or no emphasis placed upon the nature and quantity of gases evolved during combustion. Table V[8] presents a summary of the typical fire gases observed during the combustion of floor coverings.

TABLE V[8]

ANALYSIS OF COMBUSTION PRODUCTS FROM FLOOR COVERINGS

	Parts Per Million					
Material	CO	CO_2	O_2	HCN	NO_2	HCl
Acrylic carpet	1,100	33,300	150,000	100	1	0
Wool carpet	19,000	180,000	50,000	10,250	0	0
Acrilan	1,300	15,000	--	65	0.3	0
PVC tile	1,500	NR	NR	0	0	100
Red oak	13,600	93,000	100,000	35	10	0

The incorporation of fire retardants into carpeting materials will reduce the flame propagation rate, but through flame-quenching reactions will produce a more incomplete combustion, thus resulting in the production of more toxic by-products.

2. Mattresses and Upholstered Furniture

A study[9] was conducted by the National Fire Protection Association to gather information on single-fatality fires over a two year period. More than 4,000 cases were recorded from February, 1966 through January, 1968. Analysis of the recorded information shows that one out of six fires recorded was a clothing fire, and that smoking was the major cause of fatal fires in both the clothing fire and non-clothing fire categories. Careless use of smoking materials, matches, and lighters caused 46 per cent of the fatal clothing fires and 45 per cent of the non-clothing fires. The victims of smoking-caused non-clothing fires were spread across all age groups, but about half of them were in the age span 41-60 years. Table VI[9] summarizes the results of the single-fatality fire study.

TABLE VI

A STUDY OF 3,145 SINGLE-FATALITY FIRES

Age of Victim	Clothing Fires	Non-Clothing Fires
0-5	54	563
6-10	20	104
11-15	16	66
16-20	12	74
21-40	50	407
41-60	114	709
61-70	103	308
71-up	152	344
Not Reported	4	45
	525	2,620

(Continued)

TABLE VI (Continued)

	Clothing Fires		Non-Clothing Fires	
Sex				
Male		257		1,627
Female		268		993
		525		2,620
Cause of Death				
Gas or Smoke		88		1,378
Burns		433		1,168
Heart Attack		1		14
Other		3		60
		525		2,620
Where the Fire Occurred				
Building				
Dwelling	274		1,412	
Apartment	102		669	
Other Residential	27		219	
Institution	28		18	
Other Building	22	453	127	2,445
Transportation				
Automobile	9		105	
Other	7	16	27	132
Outside Location				
Brush and Grass	5		10	
Lawn	31		6	
Other Outside Locations	11	47	24	40
Not Reported		9		3
		525		2,620
Attendance				
Child Unattended		29		221
Adult Alone		279		1,073
Other Person Nearby		212		1,321
Not Reported		5		5
		525		2,620

(Continued)

TABLE VI (Continued)

	Clothing Fires	Non-Clothing Fires
Causes of Non-Clothing Fires		
Smoking in Bed		307
Smoking on Upholstered Furniture		237
Other Careless Smoking		61
Mishandling flammable liquid		842
Other		971
Undetermined		202
		2,620

An analysis of the non-clothing fires showed that 20.8 per cent of the fires were caused by smoking in bed or on upholstered furniture. Fifty-two per cent of the deaths in the non-clothing category were attributed to gas or smoke.

Recent studies of clothing and mattress fires show that most of the fatalities due to gas or smoke result from the person falling asleep, inhaling carbon monoxide, which complexes with the blood resulting in asphyxiation. This type of fire smolders for a period of several hours prior to onset of flamming combustion.

C. Fires in Homes, Multi-Resident Dwellings, Institutions, and Public Buildings

The fire statistics for the years 1967, 1968, and 1969 were reviewed to determine recent trends in buildings and dwellings. Table VII summarizes this data.

Detailed information is not available to classify the cause of fire, injury statistics, property loss vs. personal loss, hospitalization costs, and work loss.

TABLE VII

FIRES AND FIRE LOSSES CLASSIFIED

Location of Fire	1967		1968		1969	
	Number of Fires	Losses	Number of Fires	Losses	Number of Fires	Losses
Public Assembly Occupancies	*30,800*	*$168,000,000*	*30,000*	*$116,800,000*	*31,400*	*$121,000,000*
Amusement Centers, Halls	1,700	6,000,000	2,000	12,600,000	2,200	17,400,000
Auditoriums, Exhibition Halls	1,200	63,000,000	1,200	10,000,000	1,000	8,000,000
Bowling Establishments	1,200	12,100,000	900	12,800,000	800	10,000,000
Churches	4,800	20,600,000	3,800	21,000,000	3,900	19,700,000
Clubs, Clubhouses	1,800	8,100,000	1,300	9,900,000	1,900	10,800,000
Restaurants, Taverns	16,700	52,000,000	17,000	41,000,000	18,200	46,400,000
Terminal, Passenger	600	1,000,000	600	400,000	400	1,500,000
Theaters, Including Motion Picture	1,100	3,000,000	1,500	6,900,000	1,300	2,600,000
Other Public Assembly Buildings	1,700	2,200,000	1,700	2,200,000	1,700	4,600,000
Educational Occupancies	*9,700*	*48,500,000*	*13,200*	*52,400,000*	*14,300*	*73,900,000*
Schools	7,900	39,500,000	10,600	45,700,000	10,800	53,100,000
Colleges, etc.	1,800	9,000,000	2,600	6,700,000	3,500	20,800,000
Institutional Occupancies	*8,000*	*5,600,000*	*8,200*	*11,400,000*	*12,300*	*13,400,000*
Homes for the Aged	1,900	1,400,000	1,900	2,400,000	2,700	2,000,000
Hospitals	4,500	2,200,000	4,300	3,900,000	5,400	5,900,000
Mental Institutions					800	1,500,000
Other Institutional Buildings	1,600	2,000,000	2,000	5,100,000	3,400	4,000,000

TABLE VII (Continued)

FIRES AND FIRE LOSSES CLASSIFIED

Location of Fire	1967 Number of Fires	1967 Losses	1968 Number of Fires	1968 Losses	1969 Number of Fires	1969 Losses
Residential Occupancies	*665,100*	*$562,400,000*	*678,000*	*$663,400,000*	*670,700*	*$721,300,000*
Apartments	87,900	75,800,000	89,700	90,300,000	84,500	95,700,000
Dwellings, One and Two Family	530,500	417,400,000	539,900	493,100,000	536,400	547,700,000
Hotels	8,500	24,900,000	7,400	27,700,000	7,400	19,400,000
Motels	5,200	11,700,000	4,000	14,600,000	4,100	12,000,000
Rooming, Boarding Houses	4,800	5,300,000	3,000	5,000,000	3,000	7,800,000
Summer Cottages, Camps	3,500	6,000,000	2,900	6,500,000	3,000	8,700,000
Trailers, Trailer Courts	16,200	15,300,000	23,100	18,900,000	24,200	23,100,000
Other Residential Buildings	8,500	6,000,000	8,000	7,300,000	8,100	6,900,000
Mercantile and Office Occupancies	*51,800*	*220,100,000*	*52,800*	*256,800,000*	*62,000*	*288,000,000*
Clothing, Dry Goods Stores	4,700	19,900,000	3,900	24,500,000	3,800	15,600,000
Durg Stores	2,000	11,000,000	2,000	10,500,000	1,900	7,800,000
Food Stores, including Supermarkets	5,800	28,000,000	5,700	32,400,000	7,200	38,600,000
Furniture Stores	3,100	28,100,000	4,600	28,400,000	4,200	22,700,000
Specialty Shops, Services	3,400	11,500,000	4,800	15,300,000	10,200	27,100,000
Service Stations	5,000	7,600,000	4,500	8,200,000	3,900	6,400,000
Department and Variety Stores	4,200	21,500,000	4,000	32,900,000	4,000	35,800,000
Other Mercantile Buildings	23,600	92,500,000	23,300	104,600,000	26,800	134,000,000

D. Transportation Associated Fires

1. General Statistics

Figure 1[10] presents a summary of the number of automobile fires and the estimated yearly losses attributed to these fires for the period covering 1960 through 1969.

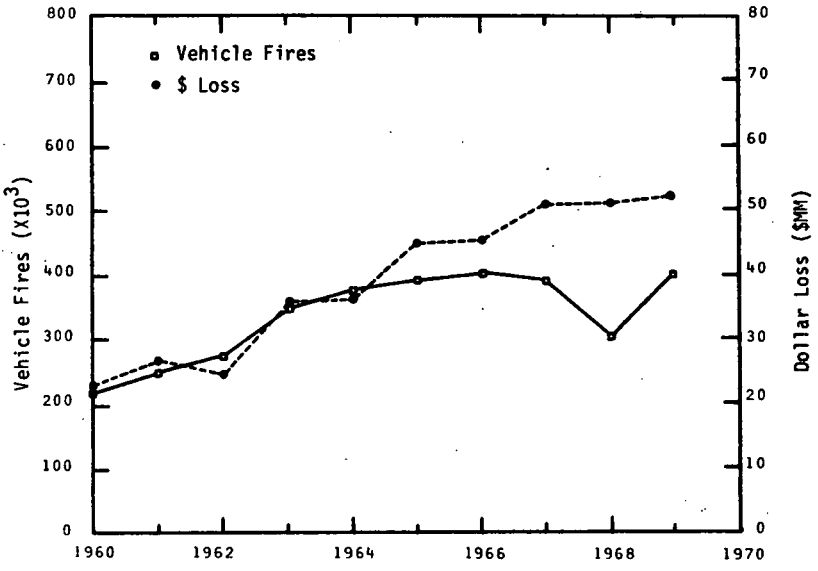

Figure 1 Automobile Fire Statistics 1960-1969

Table VIII[11] presents a summary of automotive and related fires for the period 1967 through 1969.

TABLE VIII

ESTIMATED VEHICLE LOSSES DUE TO FIRE
(1967-1969)

	Year	Number of Fires	$ Losses
Motor Vehicles	1967	396,000	$51,500,000
Motor Vehicles	1968	344,000	62,400,000
Motor Vehicles	1969	403,700	64,400,000
Construction Equipment (including farm tractors)	1967	10,500	5,000,000
Construction Equipment (including farm tractors)	1968	13,100	9,300,000
Construction Equipment (including farm tractors)	1969	15,000	12,000,000
Trailers (trailer courts)	1967	16,200	15,300,000
Trailers (trailer courts)	1968	23,100	18,900,000
Trailers (trailer courts)	1969	24,200	23,100,000

The information presented in Table VIII was obtained by the National Fire Protection Association and published in Fire Journal.[12,13,14] The statistics shown in Table VIII were obtained by the National Fire Protection Association by questionnaire sent to the fire departments of cities larger than 20,000 people. These results were based on a population of approximately 60 million people.

Meetings have been held with members of the Center for Flammability Research of the University of Utah and officials of the Fire Marshall's office, State of Utah, the Chief, Salt Lake City Fire Department, and the Fire Marshall, Salt Lake City, in order to review statistics pertaining to regional fire losses.

Table IX summarizes the Salt Lake City, Utah and national fire losses for the period 1960 through 1969.

TABLE IX

SALT LAKE CITY AND NATIONAL FIRE LOSSES
(1969-1969)

Year	Salt Lake City	National
1960	$ 972,631.00	$1,106,824,000.00
1961	1,346,327.00	1,209,042,000.00
1962	637,182.00	1,265,002,000.00
1963	1,338,744.00	1,405,558,000.00
1964	646,010.00	1,367,128,000.00
1965	3,971,671.00	1,455,631,000.00
1966	1,178,515.00	1,469,755,000.00
1967	418,174.00	1,206,717,000.00
1968	1,728,566.00	1,829,920,000.00
1969	627,467.00	1,952,622,000.00

The Salt Lake City Fire Department collects daily records for all fires to which equipment is dispatched. Table X summarizes fires involving motor vehicles in Salt Lake City, Utah for the period 1968-1970.

TABLE X

SALT LAKE CITY, UTAH - MOTOR VEHICLE FIRES
(1968-1970)

Category	1968	1969	1970
Motor vehicles, brakes (faulty or overheated)	6	6	6
Motor vehicles, carburetors (leaking, etc.)	215	213	237
Motor vehicles, electric short circuit	36	47	39
Motor vehicles, miscellaneous	--	14	18
Total Vehicle Fires	257	280	300
Total Fires (all causes)	1,622	1,497	1,688
% Vehicle Fires	15.8	18.7	17.8

The foregoing statistics do not include a breakdown of fire accidents involving property carriers.

An analysis of accidents involving fires reported to the Bureau of Motor Carrier Safety, Federal Highway Administration, by motor carriers with operating authority from the Interstate Commerce Commission[15] indicated that 735 accidents involved fire (1.69%) of 43,451 accidents reported by property carriers.

Similar statistics were reported by the Federal Highway Administration for accidents involving passenger carriers. Thirteen accidents involving fire (0.58%) of 2,225 accidents were reported by such carriers during 1968. Table XI summarizes the statistics reported by motor carriers for the year 1968.

TABLE XI

FIRE STATISTICS — PROPERTY AND PASSENGER CARRIERS

	Total Accidents	Accidents Involving Fire	Fatalities	Injuries	Property Damage
Property Carriers	43,451	735	157	356	$7,971,398
Passenger Carriers	2,225	13	25	92	156,655

Analysis of presently available information relating to cause and effect of vehicular accidents involving fire are at best only a poor indication of the true magnitude of the problem.

2. Parameters Affecting Combustion in Vehicles

a. Pre-Crash Factors

(1) Carburetors - The carburetor is the single largest cause of automobile fires. Gasoline leakage, buildup of a combustible mixture of fuel and air, or improper fuel balance cause an estimated 60% of all fires in automobiles. The use of fuel injection systems in vehicles would eliminate the carburetor and thus greatly reduce the number of fires in automobiles.

(2) Electrical Short Circuit - Electrical short circuits result in approximately 10% of pre-crash fires in automobiles. Extruded fire retardant wire coatings such as polyvinyl chloride are used in automobile applications. These materials are very difficult to ignite and tend to exhibit self-extinguishing characteristics if the flame source is removed. A high percentage of short circuits are caused by contact of the wires when the external coating is damaged.

(3) Brakes - Faulty or overheated brakes are the cause of a small percentage of automotive fires. Little information is available concerning the newer disk brakes, or self-adjusting braking systems.

(4) Interior Vehicle Components - Natural and synthetic polymers are used widely in interior vehicle components including seat cushions, seat backs, seat belts, headings, arm rests, door panels, instrument panel padding, front panels, rear panels, side panels, compartment shelves, head restraints, floor

coverings, sun visors, curtains, shades, wheel housing covers, engine compartment covers, and mattress covers. More judicious use and improved flammability characteristics of these interior components would provide increased safety to vehicle occupants during fire exposure, thus saving lives and reducing injury.

b. Crash Factors

(1) Nature of Accident - Relatively few fires occur in the occupant area of automobiles as a result of carelessness, such as dropping a pipe or lighted match on the seat or floor cover. The major cause of fire in a crash situation is caused by rupture of fuel tank or spillage of fuel or other inflammables on a heated engine block.

(2) Effects of Vehicle Speed on Fire - Speed is perhaps the major single factor determining the incidence of fires in vehicle accidents. Approximately 50% of vehicles involved in barrier impacts at speeds of 50 mph catch fire. This number rises to approximately 75% when the speed of the vehicle is increased to 75 mph.

(3) Weather Conditions - Analysis of fire statistics in the Salt Lake City metropolitan area clearly indicates the importance of ambient weather conditions. Approximately 60% of the yearly fire losses occur during the month of August in this area. Similar statistics were reported in the SAE Journal.[16] Of 65,137 vehicle accidents reported in New York State during March and September, 1968, 45 or 0.07% involved fire. On the

high-speed Thruway, however, 2.4% of these accidents burned — thirty times the average rate for the state. Forty-two per cent of the total fire accidents were reported to have occurred on high-speed roads. Of the 45 reported fires, 30 occurred in September when the average ambient temperature is about 30°F higher than in March.

c. Post-Crash Factors

Numerous factors must be considered in the consideration of post-crash factors of vehicles relating to fire. These include:

(1) Source of ignition
(2) Rate of flame propagation
(3) Attitude of vehicle
(4) Ventilation source (open doors, broken windows)
(5) Egress of occupants
(6) Temperature, oxygen concentration, and exposure to degradation products of burning materials.

Little reliable information exists concerning each of the major factors pertaining to post-crash factors. Several of these categories may also involve interactions which may markedly affect their role in ignition and flame propagation.

d. Current Status - Fire Statistics

A review of the information presented in the Introduction shows that a vast amount of information is presently available pertaining to fire statistics. Much of the information gathered provides the basis for an understanding of the magnitude of an increasing public loss. Little reliable information is available, however, which relates to the fundamental parameters governing the flammability characteristics of materials during actual fire exposure. A more important aspect of the problem relates to human response during fire exposure.

A series of disasters in recent years has focused considerable attention on the growing list of problems connected with the burning of polymeric materials such as plastics, fibers, coatings, elastomers, foams, etc. The crash of the United Airlines Boeing 727 at the Salt Lake City Airport in November 1965 was one of the most dramatic incidents illustrating the dangers arising from intense heat, toxic fumes and dense smoke, which took the lives of 41 persons out of the 91 persons aboard. This was one of the rare instances of what the Civil Aeronautics Board termed "survivable" crash with few fatalities on impact. Yet the big question remained: What was the contribution of the plastic materials inside the plane to the development of fumes and smoke? While it was thought adequate formerly to increase flame resistance to an acceptable level, the hazards due to smoke generation were, in general, not fully understood and recognized. Disasters of the Salt Lake City type clearly spell out the need for the use of plastic materials that exhibit both adequate flame resistance, as well as low smoke generation. The necessity exists, therefore, for the development of plastics with these properties and the more accurate evaluation of such materials to allow prediction of their behavior in emergency situations.

The solution to these problems is complicated greatly by the fact that many small scale laboratory tests on flammability often give poor correlation with the performance of these materials in actual fires. Yet, the selection and acceptability of polymers in various applications is determined on the basis of these tests which may not tell the complete story with regard to their behavior as flame-resistant materials. Federal, state and local authorities have passed or proposed fire safety legislation governing the use of plastic products after becoming aware of these diffi-

cult and dangerous problems. Typical examples are the amendments to the Flammable Fabrics Act (S-1003) to include home furnishings and apparel. A new federal standard (UL 478) requires the use of fire-retardant materials throughout electronic data-processing and computer installations. A federal standard (Docket 3-3) has been proposed by the Department of Transportation calling for the use of self-extinguishing materials in the interiors of all motor vehicles. Likewise, the Federal Aviation Agency now requires that all materials used in new aircraft be self-extinguishing. In a similar fashion, all Military Service Branches have set up regulatory practices and specifications governing the use of fire-resistant polymers. However, it is very clear that despite the research work going on at different government, industrial, and university laboratories, concerted efforts are necessary to evaluate and determine the importance of the fundamental parameters relating to the burning characteristics and thermal degradation of polymers. The enactment of Public Law 29-259 (Fire Research and Safety Act) by the 90th Congress in 1968 placed the responsibility for coordinating research and development within the government under the jurisdiction of the National Bureau of Standards. Thus, for the first time, a centralized, non-biased organization will, to a large degree, coordinate the national effort to solve the important problems relative to fire safety.

A critical analysis of the hazards to life support in fires involving plastics has been carried out by the authors. The burning process takes place in several steps:

1. A destructive distillation of the plastic takes place, producing gases whose nature depends on the composition of the material.

2. Oxygen unites with free carbon to form carbon monoxide. At this time dense smoke is usually formed, presenting additional hazards.
3. When sufficient oxygen is present, it combines with the flammable gases produced in the first step, as well as with carbon monoxide. If sufficient excess oxygen is available to combine with all the combustible materials, the carbon monoxide burns to form the relatively harmless carbon dioxide. Ordinarily, the products of complete combustion are less harmful than those of incomplete burning.

Thus, consideration of those parameters affecting the combustion of plastics has led the authors to rate the hazards to life support in the following order of decreasing importance:

1. Asphyxiation -- caused by rapid depletion of available oxygen
2. Attack by superheated air or gases (Maximum survivable temperature)
3. Smoke development
4. Toxicity hazards of combustion products
5. Flame propagation.

A sixth factor must be considered which probably outweighs the factors mentioned above. It is the combined effect of the first five factors.

The Fire Gas Research Report[17] states that where oxygen is reduced to 12-15 per cent under fire conditions, muscular coordination for skilled movements is lost; between 10 and 14 per cent, consciousness continues, but judgment is faulty and muscular effort leads to rapid fatigue. Breathing

ceases when the oxygen content falls below 6 per cent. Oxygen concentrations below 6 per cent will cause death in 6 to 8 minutes.

Shorter, et al.,[18] reported that temperatures in excess of 300°F (149°C) were capable of causing loss of consciousness or death within several minutes. The temperatures recorded in several controlled experimental fires in buildings exceeded the maximum survivable level within 5 to 10 minutes. This period of time is expected to be greatly reduced in aircraft fires due to the large concentrations of available fuel.

Smoke development measurements have been made by a number of experimental techniques. Dense smoke discharged into the atmosphere by burning wood, cotton, paper, or plastics contains toxic products of thermal decomposition including carbon monoxide, hydrogen cyanide, hydrogen halides, and a number of organic irritants, such as acetic acid, formic acid, formaldehyde, furfural, etc. During the early states of a fire, the smoke may contain so little carbon monoxide that the major injuries resulting from smoke inhalation may be caused by the irritants. These attack the mucous membranes of the respiratory tract and may create conditions favoring the onset of pneumonia. In cases of actual exposure, the physiological effects of inhaling smoke depend upon its physical state. When the smoke is very hot, it will destroy tissues by burning, regardless of its chemical composition; when cooled, the smoke may be non-irritating because the irritants have been removed by condensation and settling.

In addition to causing injury or death by the methods previously described, dense smoke may prevent exit from the area of combustion by obscuring vision. This same obscuration effect may prevent location of the source of the fire and thus hinder fire control.

Many investigations have been conducted on single materials under controlled laboratory conditions. In actual fires, combustion of single materials is seldom encountered, and there is ample evidence to show that the sum of the toxicity potential of two or more gases or vapors may synergistically affect life. When encountered in a fire, the toxicity of such mixtures may be further increased by low oxygen concentrations and high temperatures. Carbon dioxide, for example, causes stimulation of the respiratory center of the brain; and if breathed in excess during a fire, it causes an abnormally high intake of other gases causing toxic or lethal concentrations which might have been avoided if carbon dioxide had been absent.

Although the lungs and associated structures are principal sites of action for irritant fire gases, corrosive vapors such as acids and acetaldehyde will also affect the unprotected skin. Whatever the tissue exposed, the effect will cause inflammation. If the concentration of irritant gas or vapor is high or the exposure prolonged, fluid accumulates in the respiratory organs, being drawn from the blood and tissues. This condition is called tracheal, bronchial, or pulmonary edema, according to the level in the respiratory tract which is affected.

To date, the major concern of those engaged in the development of fire-retardant materials has been the reduction of the ignition tendency and flame propagation. Thus, it has been possible to meet code and regulatory requirements regarding flame spread, but in the opinion of the authors, the total hazard resulting from incomplete combustion has been increased. A study of several recent fires has indicated that smoke development and the production of copious amounts of toxic decomposition products have resulted

in the loss of life or bodily injury long before the spread of fire has reached those individuals trapped in the conflagration.

In addition to an increase in hazards caused by improper methods of fire-retardation of plastics, recent studies conducted by the author have shown that the flammability characteristics measured by small scale testing procedures, with slow heating rates, do not correspond with the performance of the same materials in actual large scale fire exposures. The incorporation of a fire retardant into a polymeric composition will lower the thermal degradation temperature of the polymer. If the material is exposed to a flame in an environment of rapidly diminishing oxygen content, the fire-retardant material may burn more readily than the non fire-retardant composition. Further studies using sensitive thermal analytical procedures have shown that incorporation of nonreactive low molecular weight retardants may lead to sublimation of the retardant prior to actual flame contact resulting in a material which also will burn more readily than the non-retarded material.

2. FUNDAMENTAL ASPECTS OF COMBUSTION AND DEGRADATION OF POLYMERIC MATERIALS

The burning process of a unit mass of material can be considered to proceed in several stages, depending upon the source of ignition, geometry, attitude, environment, and material characteristics, both molecular and macroscopic. The flow chart (Figure 2) illustrates a schematic representation of the stages mentioned above.

Stage I-A - Primary Thermal Processes

Heat from an external source is applied to the material gradually raising its temperature. The rate of temperature rise depends upon the temperature and flow rate of the heat source, the temperature differential, as well as the basic characteristics of the material, such as specific heat, thermal conductivity, heat of chemical reaction, heat of fusion, heat of

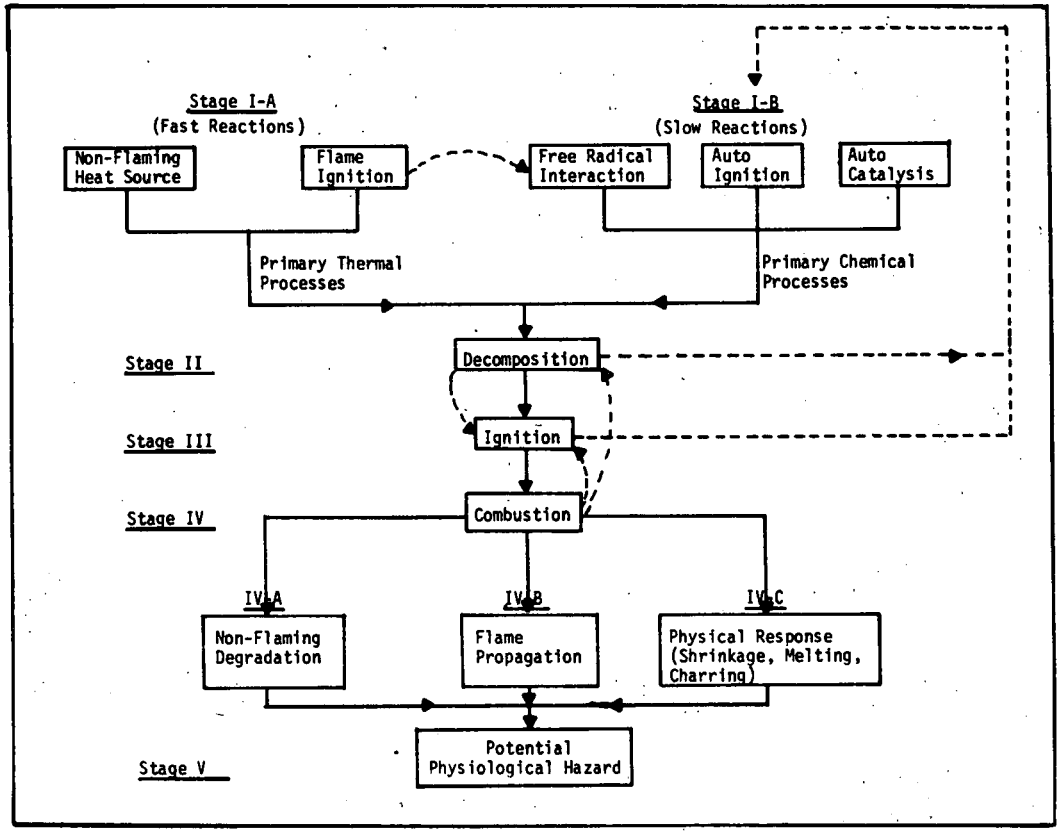

Figure :

SCHEMATIC REPRESENTATION OF COMBUSTION AND THERMAL DEGRADATION

vaporization, or other changes which may take place during the heating of the material. The geometry of the material and its attitude may considerably affect the burning process. Such factors as pre-ignition heating, radiant feedback or feedaway may substantially change the ignition and flame propagation characteristics after ignition.

Stage I-B - Primary Chemical Processes

In addition to thermal energy, the external heat source may also introduce free-radical species for chain-branching reaction. In addition, the heated material can be auto-reactive because of either a high heat of reaction or the generation of its own catalyst. In either case, the reaction rate is further accelerated in a manner which can then be independent of the primary thermal process. Lastly, the heated material can generate gaseous or adsorbed oxygen. In general, the accumulation of energy by such bootstrapping chemical processes is initially slow.

Stage II - Decomposition

As soon as the materials reach their decomposition temperature, the following types of products may be formed as seen in the schematic representation of polymer degradation shown in Figure 3.

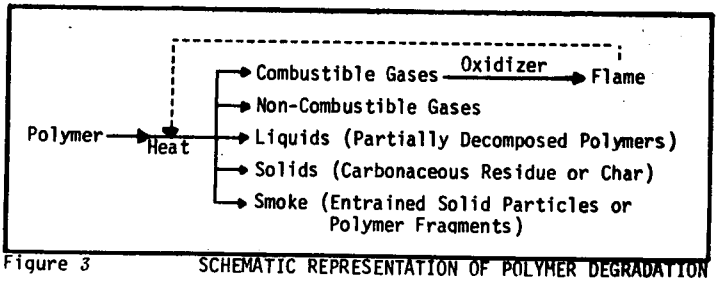

Figure 3 SCHEMATIC REPRESENTATION OF POLYMER DEGRADATION

Elimination of combustible gases, i.e., gases which will burn in the presence of air, would effectively preclude burning. However, in most instances, this is impossible since most organic materials cannot be reduced to a highly carbonaceous residue without the release of some volatile, hydrogen-containing compounds. Typical combustible gases are hydrogen, methane, ethane, ethylene, formaldehyde, and carbon monoxide. Typical non-combustible gases (i.e., do not burn in the presence of air), include hydrogen chloride, hydrogen bromide and carbon dioxide. The most desirable products of decomposition are the solid carbonaceous residues or chars since they help to preserve structural integrity and protect adjacent masses from decomposition. They also prevent mixing of air with combustible gases.

The decomposition stage is greatly affected by the following factors:

a. The temperature of initial decomposition.

b. The heat of decomposition, or heat absorbed or released during decomposition.

c. The manner in which the polymer decomposes, i.e., the relative amounts of the various products of decomposition.

Stage III - Ignition

In the presence of a sufficient amount of oxygen or an oxidizing agent, the combustible gases ignite. Ignition depends upon the following characteristics of the material:

a. The flash-ignition temperature, i.e., the temperature at which gases evolved from the material can be ignited by a flame or a spark.

b. The auto-ignition temperature, the temperature at which reactions within the material become self-sustaining to the point of ignition.

c. The minimum level of oxygen necessary to sustain ignition and combustion.

Stage IV - Combustion

The most important characteristic of the material in this stage is its heat of combustion, i.e., the energy that is released during burning. The net thermal effect of combustion can be either negative or positive. If it is negative, an external supply of heat is necessary to support combustion; if it is positive, the excess of heat is made available to increase the temperature of the adjacent material.

Sub-Stage IV-A - Non-Flaming Degradation

Many materials will degrade or smolder by a non-flaming process long before the advent of flame propagation. In fact, some materials do not combust in normal oxygen environments. This is not to say that these materials are not hazardous, for if they transport heat at a rapid rate, they may cause severe local burns. With the exception of those materials with high thermal conductivity the basic characteristics mentioned here are those desirable for wearing apparel.

Sub-Stage IV-B - Flame Propagation

Propagation results when the net heat of combustion is sufficient to bring the adjacent mass to the combustion stage. The ease with which the material is brought to this stage depends upon its chemical structure, geometry, and attitude. It should be apparent that an oxidizing agent is generally required to sustain combustion. Some materials, in their degradation process, release oxygen and then will support combustion at a limiting oxygen index of less than 20 per cent; however, other materials require oxygen from the environment to support combustion. For the latter materials, the effect of

weave, denier, etc., will greatly influence flame propagation. A typical example of the effects of fabric geometry can be seen in a comparison of flame propagation characteristics of a loose-knit sweater versus that of an angora-type fiber sweater. The loose-weave fabric will burn with a slow propagation rate because of small precursor heating of the adjacent material, while the angora fabric, with its high surface area, will enhance combustion and thus burn with a more rapid propagation. For this reason, propagation is often treated as a surface phenomenon and hence surface flame spread is considered as a realistic measure of propagation for materials.

Sub-Stage IV-C - Physical Response (Shrinkage, Melting, Char Formation)

Straehl[19] noted that synthetic fabrics such as polyamide and polyesters shrink considerably at relatively low temperatures. This shrinkage can be serious in clothing fires. Synthetic underwear shrinks onto the body when the outer wear burns; it makes, furthermore, excellent thermal contact with the skin and if the underwear catches fire, the results are likely to be fatal. Yet no textile flammability test measures or mentions shrinkage.

The burning droplets from melting synthetics can make particularly deep and serious burns according to medical reports. Wool, as well as synthetics, can shed burning pieces, but the drips from wool can be caught by the hand because of the low thermal conductivity of wool. But drops of many synthetics are molten and of moderate thermal conductivity--they stick and burn. The char from wool is a foam of low relative density, and like all foams is a good insulator and makes poor thermal contact with the skin. It also has low heat capacity.

Einhorn and Mickelson[20] reported on the formation of char structure during the combustion of model urethane foams retarded with reactive and non-

reactive fire retardant(s). The rigid urethane foam specimens, possessing a high degree of aromaticity in the polymer backbone and a cross-link density of less than 340 developed strong continuous char structure during burning. When the cross-link density exceeded 400, intumescence and slight melting occurred. As the cross-link density exceeded 500, there was no evidence of char formation and the samples were totally consumed. As the degree of aromaticity was reduced, the effective formation of char structure diminished. All flexible urethane foam samples, similar to those used in clothing insulation, burned to complete destruction. Evaluation of the data obtained in numerous laboratory experiments strongly indicated that the parameters that affect the development of improved thermal stability and flammability characteristics of cross-linked polymers are:

1. the degree of aromaticity in the polymer backbone,
2. the nature and functionality of the monomers,
3. the molecular weight per cross-link density, and
4. the nature and method of incorporation of additives into the polymer system to retard combustion.

Further research in our laboratories is being directed towards the understanding of the mechanism and kinetics of combustion of polymer systems in an effort to establish an understanding of principles which will permit the development of polymers with a high degree of thermal stability and fire resistance.

Stage V - Potential Physiological Hazard

Numerous test methods have been promulgated to evaluate the flammability characteristics of fabrics. These methods of evaluating the combustion properties of fabrics may be divided into five general classes according to the properties they are intended to measure:

1. Ease of ignition
2. Combustion duration
3. Combustion behavior
4. Flame propagation
5. Gas and smoke evolution, (in confined spaces).

Considerable variation may be encountered in the results obtained depending on the processing characteristics of the material, the molecular structure of the fabric, the method of fire retardation, and the variation in testing procedures. The methods used to rate the parameters of combustion do not take into consideration or attempt to evaluate the potential hazards to life of those individuals involved in a fire.

An understanding of the potential physiological hazard to humans during fire exposure can be gained using as an example the medical aspects of clothing burns. The question may be raised -- What is a burn? Crikelair[21] considers a burn as a reaction of an entire organism to external temperatures of sufficiently high degrees to cause skin changes or destruction. Burns are generally classified as 1st, 2nd, and 3rd degree. A first degree burn is an inflammatory response which may be painful. There is no destruction of skin and no scarring. Three parameters which determine the degree of burn severity are:

1. The degree of heat.
2. The length of exposure to the body surface.
3. The total area of contact with heat.

A second-degree burn is the result of partial destruction of the secondary skin appendages. This type of wound may be self-healing as the epithelium grows from the depths of the remaining portions of skin appendages.

Destruction of secondary skin appendages alone is not sufficient to classify a burn as third-degree. Underlying tissues such as fat, muscle or even bone may be destroyed or damaged in third-degree burns.

The classification of the severity of a burn is relatively easy. The response of an individual's system to a burn depends on the type of burn, the extent of the burn, the age and relative health of the individual and other extenuating factors such as the resistance to secondary infection.

Physicians generally follow the "rule of nine" to express the extent of a burn. One arm is 9%, a leg (front surface) is 9%, leg (back surface) is 9%, etc. The percent of the body involvement is important for treatment and for plotting survival figures. If a third-degree burn involves 50% of the body surface, the mortality rate is about 50%. If a third-degree burn involves 70% or more of the body surface, survival is nil.

Crikelair[21] described five phases in the response of a patient to severe burns:

1. The shock phase - A 48 to 72-hour period during which extensive intravenous fluid replacement may be required to control loss or shift of body fluids or electrolytes.
2. The septic phase - The skin controls body temperature and protects the body from bacteria and the traumatic environment. This phase proves fatal to most severely burned patients and may last from days to months.
3. Skin grafting phase - After the burned tissue separates, skin grafts need to be applied. This phase may extend for long periods of time and may require extensive medical care.
4. Convalescent phase - Following skin grafts, a considerable period of time may elapse during which the patient must

overcome numerous physiological and psychological effects of injury.

5. Reconstructive phase - This is the period during which the plastic surgeon endeavors to restore appearance and function of the involved parts of the body. Many of these procedures are elaborate; all are time-consuming and require frequent operations and often long periods of hospitalization.

3. TOXICOLOGICAL RESPONSE

Normally one expects that flame contact is the major cause of injury and death during fire exposure. Perhaps the first event focusing attention to the hazards of fire from a plastic material was the Cleveland Clinic fire in 1929, in which X-ray films, composed of highly combustible nitrocellulose, caught fire and brought death to 125 persons. Analysis of the death pattern revealed that most of the deaths were not due to flame contact but were a consequence of the production of carbon monoxide and nitrogen oxides. Since then numerous other fires in this country have also led to deaths not only due to the actual flames but to the gaseous products evolved from synthetic materials. Not too surprising, however, is the fact that research on the toxicological aspects of pyrolysis and combustion during fire

exposure has lagged so far behind other aspects pertaining to the flammability characteristics of polymeric materials that even a fair assessment of the toxic hazards cannot be adequately described at this time except in great generalities. The time has passed for the toxic consequences during combustion to be ignored or minimized.

When a polymeric material is heated, sufficient energy may be introduced into the system to break the weak chemical bonds between the polymer chains as well as to break the covalent bonds with the polymer chains.

Consideration must be given to those factors which will be responsible for the death or serious incapacitation of persons in or near the vicinity of a fire. The major factors affecting life support are listed below:

1. Direct consumption by the fire
2. Extremely high temperatures
3. Absence of oxygen
4. Presence of carbon monoxide
5. Presence of other gases
6. Presence of smoke
7. Development of fear.

From a toxicological point of view, factors (3) to (6) become important considerations since factors (1) and (2) will cause immediate death, while factor (7) may or may not lead to death, depending upon whether a panic-strickened person makes a rash decision such as jumping into the path of an oncoming vehicle or making contact with fallen power lines.

Exposure of humans to the various combustible gases as well as the particulate matter in smoke may bring about acute episodes of toxicity, ranging from minor irritant effects to death.

In real fire exposure it becomes nearly impossible to ascertain which one or two agents (excluding absence of oxygen, presence of carbon monoxide, and perhaps direct evidence of large quantities of particulate matter in the upper respiratory tract) caused death. It becomes even more difficult to ascertain the toxic potential of a specific material when it burns or is heated. Presently, the simplest approach is to have some knowledge of what gases are formed and to seek toxic information on the individual compounds if such knowledge is available. From this point on, the problem of identifying the role of a single product on life support becomes greatly magnified since the combination of products being inhaled may not, and generally does not, produce the same biological response as when only one of the compounds is inhaled. The therapeutic effect of one drug may be appreciably enhanced or reduced when the patient has been exposed to prior drugs or when he is exposed to combinations of drugs.

When man is placed in contact with a chemical agent, it can produce an acute toxic effect in a number of ways, the most important of which are listed below:

1. The compound may act as a primary irritant upon the skin and/or on mucous membranes.
2. The compound may be absorbed into the blood stream, leading to definite toxic symptoms and signs, and which may result in death on continued exposure.
3. The compound may act as a sensitizing agent, producing antibodies to the antigen. A repeated exposure to the same, or nearly similar compound may produce allergic manifestations ranging from mild to very serious.

4. The compound may be absorbed in very low concentrations, producing no definite signs and symptoms of toxicity, but may affect mental functions.

The first two can lead to rapid death during fire exposure, or if not death, may result in sufficient damage to cause hospitalization. The third (sensitizing agent) consequence has not received much attention in regard to fires but it should not be overlooked, at least in those cases where death does not occur or even in those instances in which no apparent harm is noted. An allergic response may, however, develop at another date but may have been initiated due to the fire or the pyrolysis of a polymeric material. Finally, low levels of a compound may be sufficient to alter mental functions which, in turn, lead to serious accidents or consequences for the person as well as for a larger number of individuals.

Toxic Effects From Gases and Thermal Degradation Products

Oxygen

In this case the important factor is the absence of oxygen rather than the release of oxygen due to fire or pyrolysis of polymeric materials. Complete lack of oxygen will lead to death within a few minutes and lesser concentrations of oxygen in the air than normal will produce a number of signs and symptoms of hypoxia in persons exposed to that environment. Even if death does not occur due to the lower levels of oxygen in the immediate atmosphere, denial of sufficient oxygen to brain tissue for short periods of time will produce irreparable brain damage. Higher concentrations of oxygen, but still below that considered normal, will affect the brain cells in a reversible manner, but during this period the person will have behavioral changes which may produce faulty judgment leading to serious accidents and possible death or grave injuries to himself as well as others. Table XII[22]

presents estimates of the signs and symptoms due to oxygen deficiency.

Table XII

SIGNS AND SYMPTOMS OF TOXICITY OF REDUCED LEVELS OF OXYGEN DUE TO FIRE CONDITIONS

% of Oxygen in Air	Sign or Symptom
20% (or above)	Normal
12 to 15%	Muscular coordination for skilled movements lost
10 to 14%	Consciousness continues but judgment is faulty and muscular effort leads to rapid fatigue
6 to 8%	Collapse occurs quickly but rapid treatment would prevent fatal outcome
6% (or below)	Death occurs in 6 to 8 minutes

Carbon Monoxide

Out of all the gases generated from the burning of a material (both natural and synthetic), the gas which produces the most deaths in real fire situations is carbon monoxide. Even though present air has levels of carbon monoxide in parts per million, animals and man apparently can tolerate concentrations up to 100 ppm for short periods of time (up to eight hours) without any undue harm. Fire conditions, however, can release large concentrations of CO in air and these levels can lead to death in very short periods of time. The main action of carbon monoxide after it is

inhaled is to combine reversibly with hemoglobin (Hb) to form carboxy-hemoglobin (CO-Hb). This reaction displaces oxygen in the blood and leads to apoxia and death if the reaction is not reversed. Carbon monoxide also interferes with oxygen release in the tissues but this appears to be of secondary importance as compared to combining with hemoglobin. Both animal and human studies have demonstrated that correlations can be made between signs and symptoms of toxicity and the percent CO-Hb formed. Table XIII[23] summarizes this information and shows that concentrations below 10% produce no signs or symptoms. Most medical personnel and toxicologists agree that, in general, most persons will not show toxic symptoms below a level of 20% carbon monoxide. From this level on, however, extremely toxic manifestation will occur and death will be imminent in concentrations of 60% or more.

In recent years attention has been given to possible toxic effects of carbon monoxide at levels where signs and symptoms of toxicity are not noted, as for example, below 10% CO-Hb. Schulte has explored this problem and has found that concentrations as low as 5% CO-Hb can affect certain psychomotor abilities.[23] For example, in experiments with humans he noted that both the rate of errors and the time needed to complete an arithmetical chore would increase. He also employed other tests in his human experiments and came to the conclusion that low levels of carbon monoxide could have, and most likely do have, an effect upon judgment and situational decisions and responses.*

If low concentrations of carbon monoxide can indeed affect decision

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*Some investigators have reported that certain cigarette smokers may at times show up to 10% CO-Hb in their blood, depending upon the number of cigarettes smoked and the manner in which they are smoked. Other figures, however, generally show a level of less than 5%.

TABLE XIII

SIGNS AND SYMPTOMS AT VARIOUS CONCENTRATIONS OF CARBOXYHEMOGLOBIN

% CO-Hb	Signs and Symptoms
0 to 10	No signs or symptoms
10 to 20	Tightness across forehead, possible slight headache dilation of the cutaneous blood vessels
20 to 30	Headache and throbbing in the temples
30 to 40	Severe headache, weakness, dizziness, dimness of vision, nausea, vomiting and collapse
40 to 50	Same as above, greater possibility of collapse; syncope and increased pulse and respiratory rates
50 to 60	Syncope, increased respiratory and pulse rates, coma, intermittent convulsions and Cheyne-Stokes respiration
60 to 70	Coma, intermittent convulsions, depressed heart action and respiratory rate, and possible death
70 to 80	Weak pulse, slow respiration leading to death within hours
80 to 90	Death in less than an hour
90 +	Death within a few minutes

making and other psychomotor responses, the possibilities of accidents could increase, as for example in automobiles and airplanes where the driver or pilot is exposed. Much more research in this area, however, is needed to confirm Schulte's results and conclusions.

Presently, there is concern as to the possible chronic effects of low doses of carbon monoxide in the environment and the possible health effects this gas may have. Even though this may not be a problem for those interested in the acute toxic effects of heating or burning materials, the same events can help to increase the carbon monoxide level in the atmosphere.

Carbon Dioxide

All fires will produce some levels of carbon dioxide which, in turn, may be inhaled by those in the vicinity of a fire. Since CO_2 is an important constituent of the body process, CO_2 is not considered as a toxic agent. Inhalation of carbon dioxide will, however, stimulate respiration which, in turn, will increase inhalation of possible toxic components from the combustion and non-combustion gases present from the fire. It is not correct to assume, however, that toxic signs and symptoms will not occur in man. For example, inhaling of CO_2 in concentrations of 10% have caused in segments of test groups, headaches and dizziness, as well as other symptoms. Higher concentrations (above 20%) can lead to narcosis in animals and in most people.

Sulfur Dioxide

Certain natural materials, as well as man-made materials such as rubber formulations, may have sufficient sulfur content to generate sulfur dioxide directly or indirectly when the materials are exposed to heat and fire. This gas (SO_2) is a pungent, heavy gas and is extremely toxic to

animals and humans. The threshold limit value (TLV) is given as 5 ppm.* Sulfur dioxide, in contact with water (moisture), will form sulfuric acid which, in turn, produces the extremely irritant response when the gas has contact with skin. Mucous membranes, in particular in the respiratory tract and in the eye, are highly susceptible to the irritant effects. Exposure to high concentrations of the gas lead to death most likely because of asphyxiation (blockage of air transport in the upper respiratory tract). Chronic exposure to sulfur dioxide appears to have greater toxic effects upon those having cardiorespiratory diseases than those not suffering with these ailments. Epidemiologic studies have also led to suggestions that a cause-effect relationship may exist for the high incidence of death during episodes of smog.

Hydrogen Sulfide

Hydrogen sulfide, or the familiar "rotten egg" gas, is an extremely rapid and powerful systemic toxic agent. Concentrations as low as 50 ppm will generally cause toxic symptoms and concentrations such as 1,000 ppm will cause death. Lower levels in the air (below 200 ppm) can be extremely dangerous to mucous membranes through the irritant properties of the gas. Hydrogen sulfide in humans will cause headaches, nausea, confusion, and weakness and may lead to unconsciousness. Because of the rapid metabolism of the compound, death can be prevented if the persons are removed from the source of the exposure. Death generally is due to central respiratory paralysis.

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*Threshold Limit Value (TLV) - concentration of a compound in the air which if exceeded may cause toxic signs and symptoms. The concentration is a weighted average over an eight hour period of exposure.

Aliphatic Hydrocarbon

Thermodegradation of all organic polymers will produce a variety of aliphatic compounds having a range of molecular weights. The lower molecular weight compounds will produce narcosis in animals and man but as the series is ascended, the biological activity will decrease. With certain polymers there may be present unsaturated hydrocarbons when the polymer is degraded and these compounds will generally have a greater toxic effect than the saturated compound. In these mixtures there may also be present acids, alcohols, and aldehydes, each contributing a toxic property.

Aromatic Hydrocarbons

These compounds, starting with benzene and leading to other aromatic structures, will have both irritating properties as well as systemic toxicity. As the structure of the aromatic molecule is altered, the toxicity may be increased or decreased. Several of these aromatic compounds, such as benzene, will be absorbed not only by inhalation but by absorption through the skin. Levels of 100 ppm and above are considered dangerous to health. Styrene is a degradation product of polystyrene and is considered as safe in concentrations below 100 ppm. Levels above can produce irritation to mucous membranes, symptoms of toxicity and impairment of neurological functions.

Hydrogen Cyanide

Hydrogen cyanide may be a lethal agent when ingested as the salt in a dose of less than 1/4 gram. Concentrations above 20 ppm in the air are considered as dangerous to health. Initial inhalation of the vapors of HCN will cause a reflex stimulation of breathing which, in turn, will lead to greater concentration of the gas entering the body. Within a very short

time the person becomes unconscious and if not removed from the source, certain death will result. Cyanide will inactivate certain enzymes in the body and this will, in turn, prevent utilization of oxygen by tissue.

Hydrogen Chloride and Related Compounds

Degradation of polyvinyl chloride produces as one of its major degradation products, hydrogen chloride. Other compounds may result including vinyl chloride (CH_2 = CHCl) and phosgene. On combining with water, hydrogen chloride forms hydrochloric acid. This acid is less corrosive than sulfuric acid and does not produce a severe tissue response on skin but will have destructive damage on mucous membranes. If inhaled, the upper respiratory tract will be severely damaged and this may lead to asphyxiation and death. Vinyl chloride appears to be less toxic than HCl but will produce narcosis when inhaled.

Hydrogen Fluoride and Related Compounds

Fluorinated polymers, if heated to sufficiently high temperatures, will release a group of low molecular weight, saturated and unsaturated fluorinated hydrocarbons. These compounds, in particular hydrogen fluoride, are extremely toxic when inhaled in sufficient concentrations. Hydrofluoric acid results when HF combines with water. This acid is extremely corrosive to all tissue. Inhalation of this compound will produce serious damage to the mucous membranes in the respiratory tract which may lead to death, or death may be due to systemic toxicity of the compound itself. Tetrafluoraethylene may also be present but this compound is much less toxic and has been found to be non-toxic to animals exposed to levels of 40,000 ppm over a four hour period. The highly toxic octogluoroisobutylene may also form on heating polytetrafluoroethylene.

Smoke Development and Light Obscuration

One of the many aspects that is of major concern when studying flammability is the smoke evolved during the burning of polymeric materials. As fire retardants are incorporated into a polymer to retard its flammability, it is found that much more smoke is emitted.[24] Most often the smoke emitted contains large amounts of carbon in the form of soot which readily obscures light.

Mickelson and Einhorn[20] listed the principal parameters that affect smoke in polymeric materials:

1. the nature and functionality of the monomers
2. the degree of aromaticity in the polymer backbone
3. the molecular weight per crosslink density
4. the additives that may be incorporated into the polymer system to retard combustion.

Several smoke density chambers have been developed which measure the volume of smoke produced and the obscuration by photometric techniques of a high intensity "EXIT" sign. However, this type of equipment does not relate directly to the psychological response of individuals in fire exposure. For example, wool and acrylic plastics produce relatively little smoke during combustion and the test chamber shows low smoke obscuration. If, however, a person were placed in the chamber during combustion he would not see the "EXIT" sign as the effluents would cause the eye to tear. Thus, more relevant research is required to relate the true hazards during combustion.

Conclusion

The fundamental aspects of the parameters governing the combustion of polymeric materials has been discussed in detail. Special emphasis has been

placed on those aspects of combustion (e.g., ignition, flame propagation, smoke development, and the exolution of toxic decomposition products), which may affect the physiological factors governing life support during actual fire exposure.

A detailed review of fire statistics in the United States was presented. The increasing number of fires coupled with the persistent inflation makes it mandatory that more reliable measures of fire prevention be adopted during the coming years. It is, however, essential that the methods and materials used to improve the flammability characteristics of polymeric materials do not increase the total dangers to human life. Thus, more relevant research is required to relate the true hazards during combustion.

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ITEM 3. ANALYSIS OF THE LIL-HAVEN NURSING HOME FIRE

(By Irving N. Einhorn, Director, Flammability Research Center and Research Professor, Division of Materials Science and Engineering, University of Utah, Salt Lake City, Utah)

General Background Information

Six men were killed, one man suffered multiple fractures, and eleven others were hospitalized for smoke inhalation when a fire occurred at the Lil-Haven Nursing Home located at 376 North 1st West in Salt Lake City, Utah. Several other men were saved when they evacuated their rooms and were rescued by firemen.

The nursing home was equipped with automatic detection equipment manufactured by the Notifier Company, a Division of Emhart Corporation of Lincoln, Nebraska. The Thermotech detector is a rate anticipation device which activates a fire alarm whenever the ambient air temperature reaches the detector setting, thus eliminating the thermal lag inherent in conventional heat detectors.

The detection equipment sounded an alarm to the Salt Lake City Fire Department at 12:41 a.m. on Wednesday, September 15, 1971. Fire equipment was dispatched within 30 seconds of receipt of the alarm.

Battalion Chief G. L. Ferris received word of the fire by radio and because he was in the vicinity of the nursing home, returning from another fire, arrived at the fire scene at approximately 12:42 a.m. The first fire fighting equipment arrived at the scene of the conflagration at approximately 12:43 a.m. A total of twenty-two men with three engines and two ladder trucks responded to the fire. The fire was reported under control within an approximate ten minute period.

Chief Ferris reported that the entire rear of the building was on fire when he arrived. He further stated that some of the people crawled onto the roof and some jumped or fell to the ground. Chief Ferris stated that some of the residents died in their beds while others apparently tried to escape, but were overcome by the intense smoke and heat.

Analysis of the General Fire Scene

Professor I. N. Einhorn, Director of the Flammability Research Center and Research Professor of Materials Science and Engineering of the University of Utah arrived at the fire scene at 9:30 a.m. Wednesday, September 15, and conducted an investigation of the nursing home, accompanied by State Fire Marshal Robert Tanner and Salt Lake City Fire Marshal Ben Andrus.

Exterior of Nursing Home—Entrance—West Side of Building

Little evidence of damage was observed on the west side of the building. The center window in the front second story room was broken. Later examination of the interior of this room indicated that the heat exposure was not sufficient to cause the window to fracture. Evidence of smoke seepage was seen in the attic area.

Exterior View—North Side of Building

The middle room, north side, on the ground floor was determined as the area of fire origin. The windows in this room were completely broken. This damage could have been caused by the intensity of the fire within the room or the glass may have been broken by the firemen in an attempt to ventilate the area. The room on the second floor also shows evidence of fire together with broken window glass.

Exterior View—East Side of Building

Slide 3 shows a view of the second floor area to the rear of the building. It is this area that Chief Ferris reported to be the hottest area of the fire.

Exterior View—South Side of Building

With the exception of broken glass in the second floor windows and traces of slight smoke seepage at the roof joint, little evidence of fire damage was observed on the south side of the structure.

Interior Views of Nursing Home—Point of Fire Origin—Middle Bedroom, Ground Floor—North Side of Building

Origin of Fire.—The origin, and probably most intense point of fire, in this room was the southeast corner of the room. The melted electric light bulbs (Slide 5) in the ceiling fixture triangulate the area believed to have received the greatest concentration of flammable liquid. It should be noted that the partially empty metal container was also found in this area. Slide 6 illustrates the extreme fire damage found in the room of suspected fire origin. Slide 7 further illustrates the extent of damage observed in the room of fire origin. The ceiling tile in the northwest corner of the room was destroyed and evidence of strong char formation was seen on the roof supports. Slide 8 shows the area of damage closest to the point of ignition. Slide 9 presents another view of the room in which the fire was suspected to have originated.

Bathroom—Ground Floor, North Side of Building

Extensive fire damage was observed in the bathroom located on the north side of the first floor. (Slide 10).

Many plastic components, such as the wall tile (Figure 1) showed extensive distortion and melting; toilet paper holder (Figure 2) melted, although the paper did not show signs of burning; a plastic towel rack (Figure 3) was completely distorted; and the plastic wall covering next to a cotton towel was distorted (Figure 4), although the towel was not damaged.

Rear Stair Well

The rear stair well area showed evidence of extreme temperature rise coupled with an exposure to a fast flame front. A chimney effect was illustrated by the burn pattern and location of vent areas. Char depth on support members ranged from 0.25 to approximately 0.75 inch. The stairs were covered with a nylon carpet whose primary backing was polypropylene fibers. The underlayment was jute. There is strong evidence that the nylon carpet was covered with a clear plastic sheeting to prevent wear of the carpet. Samples of this plastic sheeting are being examined by personnel of the Flammability Research Center of the University of Utah. The flammability characteristics of the carpet will be discussed in depth later in this report.

Second Floor Hall Area

Extensive fire damage was observed throughout the length of the second floor hall area. Multiple layers of paper covered both ceiling and wall areas. A plastic finish, of unknown origin, appeared to have covered wall areas in part of the hallway.

Second Floor West Bedroom

Standard hollow doors with thin wood panel facings were found on each of the rooms on the second floor. Slide 12 shows that the outerfacing of the door to the west bedroom was extensively damaged with the hall wood facing badly burned.

Slide 13 shows the bedroom side of the door to the west bedroom. Although evidence of burning was observed, the panel did not show flame penetration.

Slide 14 indicates the ceiling tile in the west bedroom was buckled from its support in the center of the room by the heat but that no evidence of burning or extensive soot formation was observed.

Three victims were found in the west bedroom. It is apparent from information obtained from Professor James Weston, Medical Examiner for the State of Utah, that carbon monoxide and possibly temperature were the prime causes of death. Slides 15, 16, and 17 show views of the west bedroom. It should be noted that little discoloration of bedclothing was observed. The condensation pattern of soot is typical of a fast, hot fire. It was first believed that the hand prints observed (Slide 18) in the soot on the north wall were those of a victim. Closer examination of them by Mr. J. Ryan of the National Bureau of Standards and Professor Einhorn indicated that these prints were made by an individual wearing a glove. Personnel of the nursing home reported that the victims did not wear gloves; thus it is assumed these prints belonged to one of the firemen.

North Bedroom—Second Floor

Slide 19 shows several of the multiple layers of wallpaper hanging from the roof of the north bedroom. Moderate soot formation was observed on the walls, ceiling, and fixtures in this room.

Slide 20 illustrates the protection offered by the wood door to the clothes closet. There was almost no evidence of soot deposit and no evidence of combustion in this closet. The area to the right of the closet showed severe burn damage.

Slides 21, 22, and 23 show relatively little burn damage in this room, even though it is located above the point of origin of the fire. The bedclothes are relatively free of soot, and carbon deposits on walls adjacent to the beds ranged from minimum to only moderate. One victim was found in this room.

Southwest Bedroom—Second Floor

Slide 24 again shows the protection offered by the wood door to actual fire penetration. The exterior panel showed extensive burn damage, while the inner panel showed little evidence of direct penetration. Slides 25 and 26 present other views of the room interior in which two victims were found. Figure 25 shows the typical stratified soot pattern found in fast fires. Figure 26 illustrates temperature gradients and thermal patterns on the wall surface.

Southeast Bedroom—Second Foor

Slide 27 illustrates extensive damage to this bedroom. The occupants of this room did evacuate the building.

First Floor Sitting Room—Northwest Corner of Building

Slide 28 illustrates ceiling damage in the southeast corner of this room. Slide 29 illustrates the melting which occurred in draping material on the west and north windows. No actual burn damage was observed in this room.

Figures 5, 6, 7 and 8 illustrate plastic decorations found in this room which had undergone distortion due to heat. If desired, it will be possible to determine the temperature profile encountered during the fire by determining the melting points of the individual ornaments.

First Floor—Southeast Bedroom

The door to this room was kept closed during the fire and little evidence of actual damage or soot deposit was observed here (Slide 30).

Analysis of Accelerant

A metal can, approximately one gallon size, was found in the room believed to be the origin of the fire. This can bore the label of a Salt Lake City chemical company and was identified as Century 21 Dust Control.

The contents of this can were taken to the Flammability Research Center at the University of Utah. A Perkin-Elmer Model 237 Infrared Spectrophotometer was used to obtain infrared spectra of the unknown liquid. Curve NH–1 is the infrared spectrum between 2.5 to 8.0 microns of the unknown sample. Curve NH–1a is the infrared spectrum for the same material for the region 5.0 to 16 microns. These spectra indicate that the material found at the fire scene was a paraffinic oil composed of only carbon and hydrogen atoms.

A one gallon sample of Dust Mop Control was obtained from the Century 21 Marketing Company. This sample was brought to the University of Utah and spectra were obtained using identical procedures. These spectra are labeled Control 1 (2.5–8.0 microns) and Control 2 (5.0–16.0 microns). Analysis of the four spectra indicates that the two chemical solutions—that found at the fire scene and the sample obtained by Inspector Gibley of the Salt Lake Fire Department—were identical. Phone conversations with personnel of the Century 21 Marketing Company indicated that they purchased the chemical from the Thacher Chemical Company of Salt Lake City. Conversations with Mr. Larry Thacher indicated that the liquid was a refined white mineral oil which was supplied by the Shell Chemical Company as their product 35 Base Oil. The identification of the product is consistent with the analytical findings.*

Mr. Thorwald Petersen, 93, a resident of the Lil-Haven Nursing Home, told Detective Ralph Whitaker and Fire Inspector Dean Callister that he had used the contents of the metal can to start the fire.

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* Control samples 1 and 2, retained in committee files.

ANALYSIS OF CARPET FOUND IN THE STAIRWAY AND HALL AREAS

A tight knit industrial weave nylon carpet, whose primary backing was polypropylene fibers, was used to carpet the stairway and hall areas of the Lil-Haven Nursing Home. The underlayment was constructed of jute.

Samples of carpet received from the Lil-Haven Nursing Home were evaluated to determine its flammability characteristics by personnel of the Flammability Research Center of the University of Utah.

Test-Procedure DDD-C-95 (Pill Test)

This small scale test is used to determine ignition and flame propagation characteristics of carpets and small rugs. The ignition source is a standard methenamine burning tablet which is ignited in contact with the fabric.

The carpet received from the Lil-Haven Nursing Home was evaluated using this procedure. Of six samples tested, four easily passed this test, two other samples barely passed this test. If 5 ml. of the accelerant was placed on the carpet prior to test, the carpet readily failed this procedure.

ASTM D-1692 Test Procedure

This small scale laboratory test was used in the horizontal, 45°, and vertical positions to evaluate the burn characteristics of the carpet samples. Table I summarizes the results of this evaluation.

TABLE I.—ASTM D-1692 TEST PROCEDURE

HORIZONTAL TEST—60-SEC. IGNITION

CARPET SAMPLE A-1

Inches burned	Time (seconds)	Remarks
0	0	
1	12	
2	19	
3	39	
4	48	Flame off, 60 sec. 4.25 in. burned.
5	105	
6	220	Flame out, 6 ft. 35 in.

HORIZONTAL TEST—15-SEC IGNITION

CARPET SAMPLE A-2

Inches burned	Time (seconds)	Remarks
0	0	
1	40	
2	135	Flame out, 4 ft. 58 in.
3		
4		
5		
6		

HORIZONTAL TEST—5-SEC. IGNITION

CARPET SAMPLE A-3

0	0	
1	62	
1.8	372	
2		
3		

HORIZONTAL TEST—5-SEC. IGNITION (MATCH)

CARPET SAMPLE A-4 (5 ML. OF ACCELERANT ADDED)

0	0	
1	9	
2	14	
3	23	
4	35	
5	47	
6	65	Flame out 390 secs.

TABLE I —ASTM D-1692 TEST PROCEDURE—Continued

45° POSITION—60-SEC. IGNITION

CARPET SAMPLE B-1

0	0	
1	4	
2	7	
3	10	
4	16	Bottom melting.
5	58	Dripping.
6	61	233 secs. flame out reverse surface glowing 2 minutes after flame out.

45° POSITION—15-SEC. IGNITION

CARPET SAMPLE B-2

0	0	
1	10	
2	12	
3	20	27 secs. melting.
4	36	30 secs. dripping.
5	45	
6	55	Flame out 23 secs. (white and black ash).

45° POSITION—5-SEC. IGNITION (MATCH)

CARPET SAMPLE B-3 (5 ML. ACCELERANT ADDED)

0	0	
1	3	
2	5	
3	7	
4	8	
5	11	
6	15	Severe flame travel approximately 14 in. beyond end of sample.

VERTICAL POSITION—15-SEC. IGNITION

CARPET SAMPLE C-1

Inches burned	Time (seconds)	Remarks
0	0	
1	12	
2	17	
3	30	
4	36	
5	45	
6	50	Flame out 285 secs.

VERTICAL POSITION—5-SEC. IGNITION (MATCH)

CARPET SAMPLE C-2 (5 ML. ACCELERANT ADDED)

0	0	
1	1	
2	2	
3	4	
4	4	
5	7	
6	10	Flame out 240 secs.

Oxygen Index ASTM D-2863

A General Electric Oxygen Index Apparatus was used to determine the limiting oxygen index required to sustain a 6" x 2" carpet sample in a vertical position. The results of this test showed that 20.2 percent oxygen was required for sustained combustion. This is approximately the concentration of oxygen found in air. As the carpet ages, is cleaned, or accumulates surface dirt, this value may be reduced downward.

Smoke Development and Light Obscuration XP–2 Chamber

The smoke development properties of the carpet obtained in the Lil-Haven Nursing home were studied using a modified XP–2 smoke density chamber, illustrated in Figure 9. The chamber measured 12 inches by 12 inches by 31 inches high and is constructed of anodized aluminum with stainless steel fittings. The door is cast aluminum with an inset fire resistant plate glass panel to permit observation of the test specimens during burning.

A quantitative analysis of the smoke density is measured by the use of a Weston Barrier Layer photocell incorporated in the walls of the chamber 11 inches above the sample support. Normally, the time necessary to reach 100% light obscuration is used as a measure of the amount of smoke being produced. However, since the approach to 100% light obscuration is asymptotic, it is very difficult to obtain times to 100% obscuration which are reproducible. Moreover, some samples can be burned completely without ever producing enough smoke to give 100% light obscuration. For these reasons, the time necessary to reach 70% light obscuration is taken as the arbitrary criterion for comparing the smoke developed in the burning of various test samples. For samples of the same material, the time to 70% light obscuration can be measured within a standard deviation of 0.4 second.

Two carpet samples were evaluated, one as received and one on which 5 ml. of accelerant were placed. The results obtained are presented in Table II. Analysis of this data shows that the carpet itself produces only a limited amount of smoke; however, in the presence of an accelerant the smoke produced by the carpet during fire exposure rises rapidly.

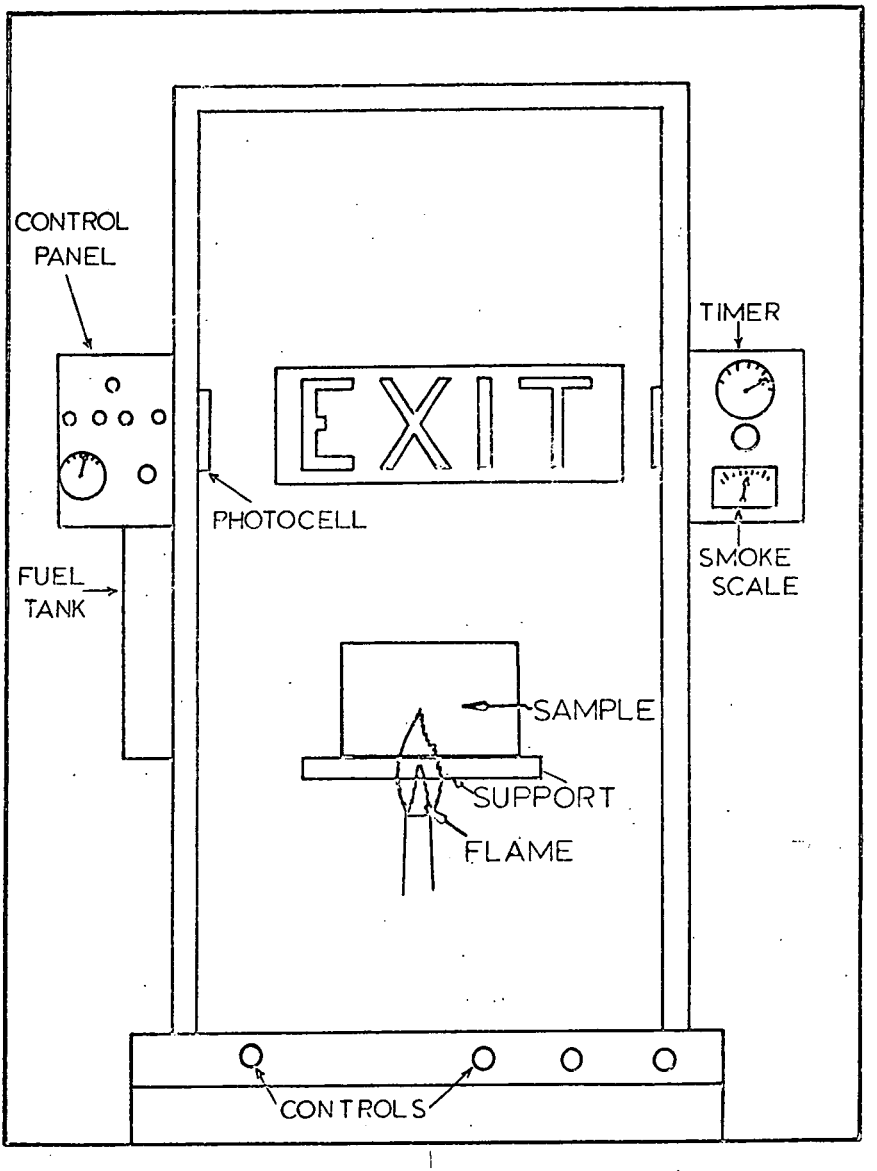


FIGURE 9. SCHEMATIC DRAWING
XP-2 SMOKE CHAMBER

TABLE II —SMOKE DEVELOPMENT—LIGHT OBSCURATION

Time (seconds)	Percent light obscuration		Time (seconds)	Percent light obscuration	
	Sample D-1	Sample D-2 (5 ml. accelerant)		Sample D-1	Sample D-2 (5 ml. accelerant)
0	0	0	150	2	92
6	0	0	180	2	98
12	0	1	210	3	99
18	0	3	240	4	99
24	0	5	270	5	99
30	0	10	300	10	
36	0	16	330	17	
42	0	15	360	26	
48	0	12	390	29	
54	0	8	420	70	
60	1	30	450	70	
90	1	70	480	70	
120	2	80			

PHOTOGRAPHIC RECORD OF CARPET FLAMMABILITY EVALUATION

ASTM D1692 Horizontal Test

A 6 inch x 2 inch sample of the carpet received from the Lil-Haven Nursing Home was evaluated using the ASTM D-1692 test procedure with the sample mounted in the horizontal position.

Slide 31 shows the carpet at time of flame contact. Slide 32 shows the first indication of flame development after the sample has been exposed to the flame source for a period of six minutes. Slide 33 indicates that the carpet sample has undergone a 1 inch flame propagation after a 30 second exposure to the flame source. A flame measuring approximately 3 inches in height is shown burning with little evidence of smoke. Little increased flame propagation was observed in Slide 34 after a flame contact period of 54 seconds. The flame source was removed after 60 seconds. Slide 35 shows reduced flame height and no noticeable advance of the flame front after an additional one minute period. Slide 36 shows that the flame has burned through to the carpet backing two minutes after the flame source was removed (3 minutes elapsed time). This evaluation was discontinued at this time period.

ASTM D1692 Horizontal Test (with accelerant)

Five millimeters of the paraffin accelerant used to start the Lil-Haven Nursing Home fire was sprayed on the surface of the carpet using a hypodermic syringe. The carpet sample was ignited with the Tyril burner during a five second exposure. Slide 37 indicates a 0.75 inch flame propagation after seven seconds elapsed time. Slide 38 shows a 3 inch propagation after an elapsed time of thirty seconds. A 13 inch flame height was observed. Slide 39 indicates a 5 inch flame spread after 60 seconds elapsed time. A moderate amount of smoke was observed at this stage of the burning. Slide 40 shows a partially burning sample. It should be noted that a 6 inch flame propagation occurred after 70 seconds elapsed time. A moderately strong flame was observed after a five minute period (Slide 41).

ASTM D1692—45° Test

Similar evaluations were made using a sample held in the 45° portion. Slide 42 shows a 2.5 inch flame height and 1 inch surface propagation after a 6 second exposure. A 3 inch surface propagation and 5 inch flame height were observed (Slide 43) after a 30 second flame exposure. A 6 inch propagation was observed after 55 seconds flame exposure. A 8 inch flame height was observed after 120 seconds elapsed time (Slide 44). The flame source was removed after 30 seconds. Slide 45 indicates an increasing flame height, 14 inches, after 240 seconds elapsed time.

ASTM D1692—45° test (with accelerant)

Five millimeters of the paraffin accelerant used to start the fire was applied to the surface of the carpet sample prior to flame contact. Slide 46 shows a 5.5 inch flame height after a 3 second flame exposure. Slide 47 shows the intensity of this fire after only a 31 second exposure. The flame source was removed after a five second period. Moderate burning was observed for 4.5 minutes after ignition.

ASTM D1692 Vertical Test

Slides 48, 49, and 50 illustrate the burning pattern observed in carpet samples ignited in the vertical position. A three inch flame height was observed after a five second ignition followed by an additional five second period (Slide 48). Slide 49 shows the total sample engulfed in flames after a 65 second elapsed time period. Severe melting and dripping was observed with a secondary fire ignited at the base of the test stand (Slide 50).

EVALUATION OF INTERIOR CONSTRUCTION MATERIALS—LIL-HAVEN NURSING HOME FIRE

Samples of interior construction materials taken from the site of the Lil-Haven Nursing Home fire were delivered to the Flammability Research Center of the University of Utah by Salt Lake City Fire Marshal Ben Andrus. Several small scale laboratory test procedures were used to determine the flammability characteristics of these materials in an attempt to determine their role in the conflagration.

A wood venier (plywood) panel coated on one surface with a gray paint was removed from the hall area. This panel was typical of those lining the egress area in several sections of the nursing home.

ASTM D–1692 Test—45°

Two samples of the plywood were evaluated using the ASTM D–1692 Test—45° sample positioning. Sample A was tested with the painted surface facing up (away from the flame source). Sample B was tested with the painted surface down (facing the flame source). Table III presents the results of this test.

TABLE III.—ASTM D–1692 TEST—45 —PLYWOOD PANELS

	Sample A (paint up)	Sample B (paint down)
Initial weight	35.8 g	35.2 g.
Final weight	22.5 g	28.5 g.
Weight loss	13.3 g	6.7 g.
Percent weight loss	37.2	19.8.

Inches burned	Time (seconds)	Inches burned	Time (seconds)
0	0	0	0
1	30	0.75	60
1.5	60	1.25	90
2.0	75	2.00	120
3.0	100		
3.5	120		

Note: The flame source was removed after 120 secs. exposure time. The samples were permitted to burn for an additional 2 minutes (4 minutes elapsed time) and were then extinguished. Both samples would have undergone complete combustion if permitted to burn freely.

Bureau of Mines Flame Penetration Test—Plywood Panels

The Bureau of Mines Flame Penetration Test was used with samples placed in a vertical position (as used in the nursing home) time of burn-through measured. Table IV presents the results of the flame penetration test.

TABLE IV.—BUREAU OF MINES FLAME PENETRATION TEST—PLYWOOD PANELS

	Sample A (painted surface in flame contact)	Sample B (painted surface away from flame contact)
Sample size	7 in by 6 in by 0.25 in	6 in by 6 in by 0.25 in
Initial weight	99.0 g	105.6 g
Final weight	82.3 g	97.0 g
Weight loss	16.7 g	8.6 g
Percent weight loss	16.8	8.4
Burn-through time: Seconds	100	130

Smoke Development-Light Observation Test

The XP-2 Smoke Density Chamber was used to evaluate the smoking tendency of the pointed plywood panels. Table V presents the results of the smoke-observation characteristics of the plywood panels. Analysis of the data presented in Table V indicated that the plywood panels did not produce excessive smoke during this evaluation.

TABLE V.—SMOKE DEVELOPMENT—LIGHT OBSCURATION—PAINTED PLYWOOD PANELS

	Sample A (painted surface up)	Sample B (painted surface down)
Sample size	2 in. by 2 in. by 0.25 in.	2 in. by 2 in. by 0.25 in.
Initial weight	11.0 g.	10.0 g.
Final weight	8.8 g.	8.6 g.
Weight loss	2.2 g.	2.4 g.
Percent weight loss	20.0.	24.0.

Percent light obscuration	Time (seconds)	Percent light obscuration	Time (seconds)
0	0	0	0
10	15	10	30
20	35	20	55
24	60	20	75
24	90	20	105
20	120	24	120
Burner off, 120 secds.:			
60	130	66	130
70	140	70	140

A composite ceiling tile, typical of those found in the egress areas of the Lil-Haven Nursing Home was evaluated for flammability characteristics.

ASTM D-1692 Test—45°

Two samples of the ceiling tile were evaluated using the ASTM D-1692 Test—45° sample positioning. Sample A was evaluated with the painted surface up (away from the flame source). Sample B was evaluated with the painted surface in contact with the flame source. Results of this study are presented in Table VI. Analysis of these test results indicated that both samples burned with a moderate amount of propagation.

TABLE VI.—ASTM D-1692 TEST—45°—CEILING TILE

	Sample A (paint up)	Sample B (paint down)
Initial weight	30.4 g.	29.1 g.
Final weight	22.1 g.	21.5 g.
Weight loss	8.3 g.	7.6 g.
Percent weight loss	27.5.	26.0.

Inches burned	Time (seconds)	Inches burned	Time (seconds)
1	80	1	55
2	110	2	90
3	120	3	105
		4	115
		4.5	120

Note: The flame source was removed after 120 secs. exposure time. The samples were permitted to burn for an additional 2 minutes (4 minutes elapsed time) and were then extinguished. Both samples were burning vigorously when extinguished.

Bureau of Mines Flame Penetration Test—Ceiling Tile

The Bureau of Mines Flame Penetration Test with samples of the ceiling tile placed in the horizontal position (as used in the nursing home) was used and time of burn-through measured. Table VII presents the results of the flame penetration test. The results obtained indicated that the ceiling tile would offer a minimum of four minutes resistance to burn-through.

TABLE VII.—BUREAU OF MINES PENETRATION TEST—CEILING TILE

	Sample A (paint in flame contact)	Sample B (paint away from flame contact)
Sample size	6 by 6 by 0.5	6 by 6 by 0.5 ft.
Initial weight	85.7 g.	88.7 g.
Final weight	76.5 g.	71.5 g.
Weight loss	9.2 g.	17.2 g.
Percent weight loss	10.8	19.4
Burn-through time	245 secs.	345 secs.

Smoke Development—Light Obscuration Test—Ceiling Tile

The XP–2 Smoke Density Chamber was used to evaluate the smoking tendency of the painted ceiling tile. Table VIII presents the results of the smoke-obscuration characteristics of the ceiling tile. Analysis of the smoke density tests showed only moderate smoke development during fire exposure.

TABLE VIII.—SMOKE DEVELOPMENT—LIGHT OBSCURATION PAINTED CEILING TILE

	Sample A (paint up)	Sample B (paint down)
Sample size	2 by 2 by 0.5 ft.	2 by 2 by 0.5 ft.
Initial weight	10.6 g.	10.4 g.
Final weight	6.8 g.	6.9 g.
Weight loss	3.8 g.	3.5 g.
Percent weight loss	35.6	33.6.

Percent light obscuration:	Time (seconds)
0	0
2	10
2	60
4	80
10	90
20	95
60	[1] 15
Flame off—120 secs.:	
70	[1] 120
90	[1] 135
94	[1] 150
Percent light obscuration:	
0	0
10	20
15	30
20	40
20	60
15	75
10	90
10	105
12	120
Flame off:	
60	[1] 125
65	[1] 135
70	[1] 140
75	[1] 150
80	[1] 155

[1] Smoldering.

Plastic Tile—Bathroom Walls

Several small samples of plastic tiles were evaluated for flammability characteristics.

ASTM D–1692 Test—45°

One plastic tile, 4'' x 2'' in size was evaluated for flame propagating characteristics using a modified ASTM D–1692 Test—45°. The results of this evaluation are shown below:

Inches burned:	*Time (seconds)*
1	15
2	30
3	35
4	37

NOTE.—The sample melted, as typical of a thermoplastic polymer and was totally consumed in 37 seconds. A secondary fire was started at the base of the test stand.

It should be noted that the actual tiles did not appear to contribute to the fire in the Lil-Haven Nursing Home. This is possibly due to the heat sink caused by the plastic backing the tiles.

Smoke Development—Light Obscuration Test

The XP–2 Smoke Density Chamber was used to evaluate the smoking tendency of the plastic tubes. The results of this evaluation are listed below:

Sample Size: 2'' x 2'' x 0.125'':	
Initial Weight—g	4.2
Final Weight—g	0.0
Weight Loss—g	4.2
Percent Weight Loss	100

Percent light obscuration:	*Time (seconds)*
0	0
2	20
4	30
10	35
20	40
30	45
40	50
50	55
50	60

NOTE.—Sample completely destroyed; secondary fire started at base of equipment. It should be noted that only moderate smoke was produced during this test.

SUMMARY AND CONCLUSIONS

Based on still incomplete findings, it is the opinion of the author that the materials examined from the Lil-Haven Nursing Home did not present an unusual risk or hazard. The normal burning characteristics and smoke development properties would have permitted normal evacuation during a fire with little or no loss of life.

Consideration must be given, however, to the conditions which led to the fire in the Lil-Haven Nursing Home. This is a clearly established case of arson in which a combustible material was applied to normal furnishing materials and ignited. The fire spread rapidly and decreased the normal oxygen supply, thus leading to the death of six occupants. It is the opinion of the author that a sprinkler system, had it been installed in the Lil-Haven Nursing Home, would have contained this fire. This coupled with the rapid containment of the fire should have prevented loss of life and greatly minimized the fire damage which occurred.

ITEM 4. UTAH STATE FIRE MARSHAL REPORT OF INVESTIGATION

Preliminary Report ☒ Supplementary ☐ Closing ☐ File No. 36 ☐

Owner(s) Jack Monte Waldron and Mary Waldron (husband and wife) 896 American Beauty Dr. D.B.A. Lil-Haven Nursing Home.

Occupant(s) Lil-Haven Nursing Home.

Location of Loss: 376 North 1st West Street, Salt Lake City, Utah, Salt Lake County, September 15, 1971, 12:41 A.M.

Origin of loss, Incendiary. Extent of damage, Considerable.

Type of building, Dwelling.

Suspicion directed to Thorvold Peterson, Age 93, arrested.

Cooperated with Fire, Police and State Agencies.

Criminal charges: 1st Degree Murder.

Status of prosecution: Confined to University Hospital for psychiatric examination.

Summary of Investigation: At 12:41 a.m. on 9/15/71, a fire of incendiary origin was reported by the automatic alarm system at the Lil-Haven Nursing Home in Salt Lake City, Utah, owned by Jack Monte Waldron and Mary Lillie Waldron. Firemen responded immediately and began fighting the fire and evacuating patients from the building. Information indicates there were 18 patients housed there at the time of the fire, six of the patients were reported dead on arrival at the various hospitals and 12 people were given treatment for smoke inhalation and injuries. Examination of fire scene determined fire originated in the hallway and north bedroom on first floor, then spread rapidly up back stairwell to upper floor through open fire door with smoke and gases causing majority of deaths on second floor. Physical evidence found in room of origin indicated fire accelerated by flammable liquid identified as dust mop oil. Thorvold Peterson, age 93, a patient admits setting the fire with use of flammable liquid to take his own life. Peterson arrested by Salt Lake City Police Department on September 17, 1971 and charged with first degree murder after which he was transported by ambulance to University Hospital for psychiatric examination to determine his competence to stand trial. (Pending.)

Details: This report contains information secured in a joint investigation by local and state agencies into the cause of the fire at the Lil-Haven Nursing Home in Salt Lake City, Utah, on September 15, 1971, which resulted in six deaths and numerous injuries.

Reporting Officer: Steve M. Kennedy. 9/21/71.

Investigation by the State Fire Marshal's Office, Salt Lake City, Utah, was initiated upon receipt of information on September 15, 1971, from Chief Ben Andrus, Fire Prevention Bureau, Salt Lake City, Utah, who informed that at 12:41 a.m. on September 15, 1971, a fire was reported by an automatic alarm system in the Lil-Haven Nursing Home, in Salt Lake City. He said there was reported to be six deaths and 12 injured as a result of the fire which warranted a full scale investigation by the interested agencies. Chief Andrus made available the following information:

The Lil-Haven Nursing Home is operated by Mary Lillie Waldron who resides at 896 American Beauty Drive in Salt Lake City, Utah, and at the time of the fire Mrs. Waldron was visiting relatives in Tennessee. Jack Monte Waldron, her husband, was on duty at the Nursing Home at the time of the fire at 12:41 a.m.

Bt. Chief G. L. Ferris was returning to the station from another fire when the alarm was received which allowed him to arrive at the nursing home 1 minute later at 12:42 a.m. He was able to assess the situation just prior to the arrival of three fire trucks, two ladder trucks, and approximately 22 men who reportedly had the fire extinguished within ten minutes after their arrival.

INSURANCE

In the name of Mary L. V. Waldron.

Policy number 564531.

Full name of company: Utah Home Fire Ins. Co.

Amount and coverage: $15,000 building; $2,000 contents.

Adjuster for the company: Utah Home Fire Insurance Co., 47 W. So. Temple, Salt Lake City, Utah. Earl Baxter, Adjusters.

Agent: State Savings and Loan Assoc., 125 So. Main, Salt Lake City, Utah.

DESCRIPTION OF BUILDING

The building is a two-story structure of ordinary construction consisting of a masonry shell with internal wood framing and composition shingles. It has not been repaneled with fire-resistive materials. A diagram of the floor plan is set forth later in this report. Ordinary construction, as set out in section 707 in the National Building Code, states: "Ordinary construction is that type of construction having exterior walls of noncombustible material having fire resistance ratings not less than specified in this section, and in which the other structural members including but not limited to columns, floors, roofs, beams, girders and joists are wholly or partly of wood of smaller dimensions than required for heavy timber construction or of other combustible material or noncombustible material."

HISTORY OF BUILDING AS NURSING HOME

This building was originally operated as a hospital for the treatment of miners consumptives in the Utah area. In 1960 it was purchased by Arden Reid and Alzora Paros and operated as the A&A Rest Home until 1963 when the name was changed to A&A Nursing Home. Mr. and Mrs. Jack Monte Waldron purchased the property in December 1964, and operated it as the Lil-Haven Nursing Home since that time. It was reported that Henry Sanchez, a relative, has a financial interest in the nursing home.

This facility was licensed as an intermediate (Nursing Home) care facility on March 15, 1971, and is reported to have been regularly inspected by the sanitarian, representative of the Salt Lake City—County Health Department. It is also reported that since the purchase of the nursing home by the Waldron's, steady progress has been made to improve the patient care standards.

The following information relates to individuals residing as patients and caretaker in the Lil-Haven Nursing Home, and reflects information furnished during their interviews following the fire:

1. Thorvold Peterson, age 93, a survivor, occupying a north bedroom on the main floor, was taken to St. Mark's Hospital, but was not admitted. He was subsequently admitted to the Fairview Nursing Home where he was interviewed at 1:30 p.m. on September 15, 1971, by Dr. Bruce Walter, and Charles Maxwell, representatives of the Utah State Division of Health, assisted by Roy West, and interpreter. Mr. Peterson is of Danish descent and speaks broken English. Mr. Peterson informed that he was in his room at the bottom of the stairs at the time of the fire. He was asked if he saw the fire, to which he replied, "yes". He indicated that he had poured a liquid on the floor and on his bed and then lit it with matches he had saved for 2–3 years to light a fire. He gave as his reason that "I wanted to burn myself up." "I hated them", "They were never able to kill me off in all those years." Further questioning in an attempt to identify, who, Mr. Peterson was referring to as "they", was not productive. He then said, "This is the only thing I could do". Upon being requestioned as to how he started the fire, he said he used a can of liquid, "I smelled it, I stuck my finger in it and smelled it". He then gestured with his hands indicating he had poured the liquid on his bed and floor. Then he said "I started the fire on the floor and on my bed". The interpreter asked Mr. Peterson similiar questions in the Danish language which he appeared to understand, but replied in English furnishing substantially the same information about the origin of the fire.

2. Daniel Zavis, Public Assistance patient, age 75, a survivor, was occupying the north bedroom on the main floor with Mr. Peterson. He was received at the University Medical Center, with small burns on his chin and nose and smoke inhalation. He was subsequently admitted to the Griffis Nursing Home where he was interviewed by Dr. Walter, Mr. Maxwell, and Mr. West at 3:00 p.m. on September 15, 1971. Mr. Zavis appeared to have some burns on his face and forehead with singed hair. He indicated that he was asleep at the time of the fire when something woke him up. He said he was assisted out of his room and the nursing home by someone. He reported he first saw the fire in the corner of the room occupied by Mr. Peterson's bed. At this time the flames were approximately 1 foot below the ceiling. He recalled that he received an injury to his forehead by bumping his head while he was being taken from his room. He said that Mr. Peterson did not smoke and he did not recall that he had any matches in his possession. Mr. Zavis stated that he did not himself smoke and that he did not have any matches in his possession.

3. Samuel Clarence Runswick, age 69, a Public Assistance patient and survivor, occupying a center bedroom, south side on the main floor was received at the

University Medical Center with smoke inhalation. He was subsequently transferred to the Fairview Nursing Home where he was interviewed at 2:30 p.m., September 15, 1971, by representatives of the Utah State Division of Health. Mr. Runswick occupied the room across the hall from Mr. Zavis and Mr. Peterson. He said he was asleep and awoke when the Fire Detection System alarm sounded. He first thought it might be a fire drill but when he opened the door into the hallway he saw the flames. He recalled observing the nursing home attendant in stripped pajamas in the hallway, but due to the fire and smoke he closed the door and proceeded to dress himself. He was assisted out of the house by firemen upon their arrival and taken to a house across the street.

4. Wesley Hudson, age 62, a survivor in the southeast corner bedroom on the second floor was received at the Latter Day Saints Hospital suffering with smoke inhalation. He was interviewed by Detective Ralph Whittaker, Salt Lake City Police Department, Inspector Dean Callister, Salt Lake City Fire Department, and Steve Kennedy, Investigator for the State Fire Marshal's Office. He said he does not know anything about the fire as he was asleep in his room when someone told him to move. He does not remember much until he awoke after arriving at the hospital. He recalled that the fire door at the head of the stair on the second floor was open and had been propped open by a small block of wood. He did not appear to be entirely coherent at the time of this interview. Following the interview he was transferred to Ann's Nursing Home in Salt Lake City.

5. Raymond Pinney, age 65, a Public Assistance patient and a survivor occupying the southwest bedroom on the main floor was received at the Latter Day Saints Hospital suffering with smoke inhalation. He advised investigators that he was sleeping when he heard a sudden racket outside and heard someone yell "Fire," and he woke up. He said he remained quiet and stayed in bed until smoke started seeping in around the door. He said at this time he became somewhat alarmed, but the firemen soon appeared and removed him and the other two men in the room to safety. He recalled that the majority of the patients got along rather well at the nursing home, but he indicated there were certain ones from the Veteran's Hospital that sometimes got into arguments. He said on occasions someone would become violent. He said he knew of no one there as a patient who might intentionally start a fire. He informed that Mr. Peterson did not particularly like him, Mr. Pinney, who presently occupied Peterson's former room, but that he felt this was largely due to Mr. Peterson's age and mental state. He said that he nor Peterson smoke and that he, Pinney, quit smoking about 10 or 12 years ago.

6. Jack Monte Waldron, age 33, care-taker and co-owner of Lil-Haven Nursing Home, a survivor was transported to the Latter Day Saints Hospital suffering with smoke inhalation. Upon being interviewed by investigators at the hospital on September 15, 1971, he advised that he is employed as a guard at the Utah State Prison and on the evening of September 14, 1971, got off his shift early sometime around 10:30 p.m. arriving at the Nursing Home shortly after 11:00 p.m. He said he was in his bedroom in the basement reading the newspaper when he heard a noise upstairs and went to make a check of the patients. He did not notice anyone in the hallway upstairs and at that time opened the door to the Peterson and Zavis room where he noticed no evidence of smoke or fire. He said he then returned to his room in the basement and started reading again when the alarm sounded. He recalled that when he arrived on the 1st floor he could see smoke coming from the Peterson and Zavis room. He said he grabbed Zavis and Peterson by the arms and started leading them down the hallway to safety, however, he lost Peterson at this time when he broke away going into the front room, so he, Waldron, continued outside with Mr. Zavis. He attempted to re-enter the building at that time, but was prevented from doing so by the heat and smoke in the hallway. He then proceeded to the south side of the building where he entered through the kitchen door into the basement apartment where he heard the fire sirens as he was talking with the telephone operator. He said he hung up the phone when he realized the fire department had been notified of the fire. He then proceeded upstairs and outside where he assisted other patients from the building. Mr. Waldron mentioned that Danny Collishaw and Daniel did not get along well together. He said that Collishaw was mentally retarded and often yelled and fought with Mr. Zavis. He recalled that when he observed Collishaw shortly after arriving home from work he was lying on his bed fully dressed. (It is to be noted that when the body of Collishaw was taken to the morgue his body was covered only with a pair of shorts).

7. Graves Christensen, age 70, a survivor occupying the center bedroom, north side on the second floor was received at the Latter Day Saints Hospital suffering from smoke inhalation. He informed investigators when interviewed at the hospital on September 15, 1971, that he was rescued by firemen from his room on the second floor. He recalled that Mr. Rijos had gone through the window, but he did not know whether or not Mr. Rijos was still alive. He said he likes the nursing home and is aware of no problems between the landlord and tenants. Mr. Christensen was subsequently transferred to the Foutz Nursing Home, in Salt Lake City.

8. Norman Lee, age 44, a survivor in the center bedroom, north side on the second floor was transported to the Latter Day Saints Hospital suffering with a fracture of the spine, pelvis, and leg, and 1st and 2nd degree burns. He was subsequently transferred to the Veteran's Hospital for treatment. Mr. Lee sustained these injuries when he leaped from a window on the second floor.

9. Steve Solovich, age 66, a survivor, was assigned to the center bedroom, south side on the second floor. He was admitted to the Veterans' Hospital with singed hair and suffering from smoke inhalation. Mr. Carl Swensen, who resides next door to the nursing home and was one of the first individuals to arrive on the scene, reported that Solovich, was outside on the lawn having a cigarette when he was first observed upon his arrival on the scene. He indicated that the fact that Solovich was out on the lawn was not unusual as he sleeps outside during most of the summer. Solovich was subsequently transferred to the Foutz Nursing Home in Salt Lake City.

10. Kimball Buckalew, age 73, a public assistance patient, and survivor, who occupied the southwest bedroom on the main floor was transported to the University Medical Center suffering from excessive smoke inhalation. He was subsequently transferred to the Foutz Nursing Home.

11. Altefugo Romero, age 67, a survivor assigned to the southwest bedroom on the main floor with patients Buckalew and Pinney was admitted to the Holy Cross Hospital for treatment of excessive smoke inhalation and then transferred to the Veteran's Hospital.

12. Marriner Bone, age 35, escaped the fire by use of the ramp from his bedroom located in the southeast corner on the second floor. He was admitted to the Holy Cross Hospital suffering from smoke inhalation. He was subsequently transferred to the Veteran's Hospital then admitted to the A&E Nursing Home.

13. Joe Montano, age 69, a railroad retiree and public assistance patient had been residing at the Lil-Haven Nursing Home from July 29, 1971, until September 1, of this year when he moved to a hotel at 127 West-4th South in Salt Lake City, Utah.

14. Lloyd Hammer, age 73, deceased, was occupying a bedroom at the west end of the second floor, along with deceased patients Danny Collishaw and Henry Gifford. He was pronounced dead on arrival at St. Mark's Hospital. The cause subsequently determined as Carbon Monoxide Poisoning.

15. John Opdahl, age 71, deceased, had been occupying the center bedroom south side on the second floor. He was dead on arrival at the St. Mark's Hospital from Carbon Monoxide Poisoning.

16. Estaben Rijos, age 69, deceased, was assigned to the center bedroom north side on the second floor. He attempted to escape by jumping from a window from his room and was killed when he landed on his back and head. He was reported dead on arrival at the Latter Day Saints Hospital.

17. Henry Gifford, age 69, deceased, a public assistance patient, was reported to have died shortly after being admitted to the Latter Day Saints as a result of Carbon Monoxide Poisoning. He occupied a bedroom on the second floor at the west end of the building.

18. Danny Collishaw, age 30, a public assistance patient, was pronounced dead on arrival at the Holy Cross Hospital due to Carbon Monoxide Poisoning. He had

been occupying the west bedroom on the second floor with two other patients who succumbed to the fire.

19. John Radtke, age 76, was reported dead on arrival at the St. Mark's Hospital. He was subsequently determined to have died from Carbon Monoxide Poisoning. He was assigned to the center bedroom, south side on the second floor, with patients Opdahl, and Solovich.

On September 15, 1971, the fire scene was inspected by the following individuals and their respective agencies, State Fire Marshal, Robert A. Tanner, and Steve M. Kennedy, Investigator for the State Fire Marshal's Office, Chief Ben Andrus, Fire Marshal and Dean Callister, Investigator, Salt Lake City Fire Department, and Detective Ralph Whittaker, Salt Lake City Police Department. The location of the fire scene was noted to be 376 North 1st West in Salt Lake City, involving a two-story building of masonry and wood construction. The structure length-wise runs east and west and fronts on the west side. The second floor on the east end of the building is on the ground level.

The examination of the interior of the building determined that the fire appeared to have originated in a back bedroom on the north side on the main floor. A close inspection of the interior of the room noted heavy charring along the walls extending to the baseboard along the east, and the north wall at the head of the bed. (It is to be noted the mattress to this bed had been removed by the firemen at the time of this inspection.) In the same general location a near empty 1-gallon silver colored can, with cap off, labeled "Dust Mop Control", (oil) was recovered and retained as evidence by Dean Callister, Salt Lake City Fire Department. A cap to the can was located on the adjoining bathroom floor at the side of the tub near a supply closet. A sample of fluid from the 1-gallon can was secured by Inspector Callister, and turned over to Professor Irving Einhorn, research center, University of Utah, for analysis and comparison purposes.

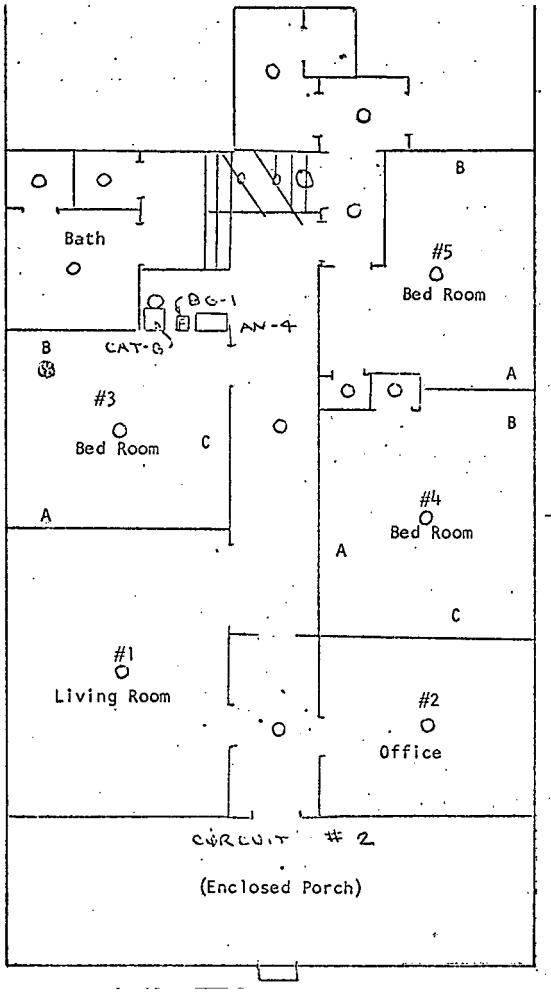
The examination further determined that the fire appeared to have spread from this bedroom through the hallway to the rear of the building and up the back stair well to the second floor. It then vented through an open fire door into the southeast bedroom and through an open door to the ramp at the rear of the building.

It appeared that although the body of the fire had been confined to the rear of the structure, heavy smoke and gases were rapidly extended through the hallway toward the west end of the building on the second floor causing deaths from Carbon Monoxide Poisoning to most of the victims.

Numerous photographs were taken at the fire scene by interested agencies and will be available for inspection at a later date.

A comparative sample of the "Dust Mop Control", oil, was obtained from Mr. Jim McGill, Century 21 Marketing, Incorporated, 5448 Riley Lane, by Mont Gibby, Salt Lake City Fire Department, and made available to Professor Irving Einhorn, University of Utah, research center for comparison with the same of liquid obtained from the 1-gallon can found at the scene of the fire. It was subsequently reported by Professor Einhorn that the qualities or composition of the two liquids were identical. The flash point for the liquid was approximately 200°.

The diagrams set forth on the following identified pages reflect the location of the various rooms contained in the floor plan, identified as the basement, main floor, second floor plans of the building. The drawings of the room are numbered consecutively, 1 up through the total number of occupied rooms on each floor. The occupants of the rooms are identified by reference to letters in the alphabet, A through C, indicating each of their locations in each room with the individual deaths indicated by an asterisk. The general area where the fire originated is designated by a circled asterisk.



#1

A - Living Room

#2

A - Office

#3

A - Thorvald Peterson
B - Daniel Zavis
C - Vacant

#4

A - Kimball Buckalew
B - Altefugo Romero
C - Ray Pinney

#5

A - Samuel C. Runswick
B - Vacant

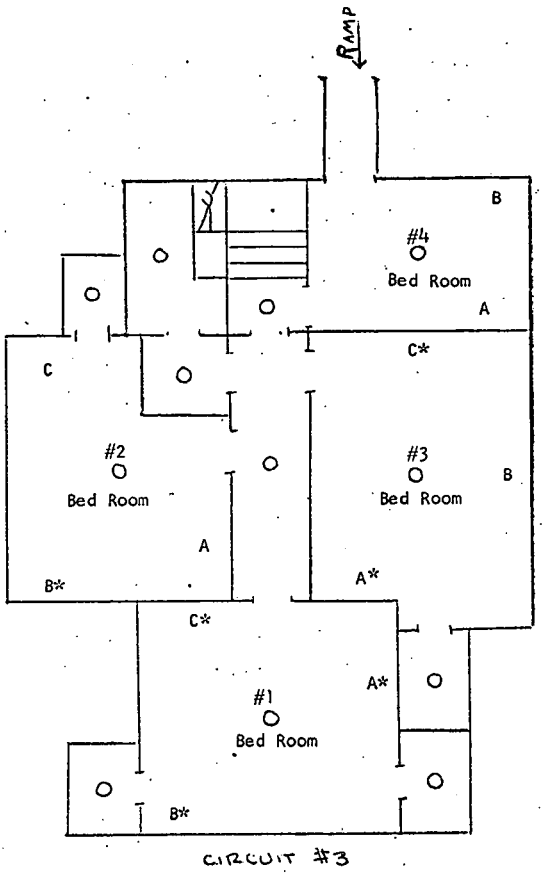
Ⓐ Indicates Room Where Fire Originated

MAIN FLOOR PLAN

SCALE 1/8" = 1'-0"

O -- AUTOMATIC DETECTION DEVICES

(Lil-Haven Nursing Home)



NORTH

#1

A - Danny Cowlishaw*
B - Henry Gifford*
C - Lloyd Hammer*

#2

A - Norman Lee
B - Estaban Rijos*
C - Graves Christensen

#3

A - John Opdahl*
B - Steve Solovich
C - Jack Radtke*

#4

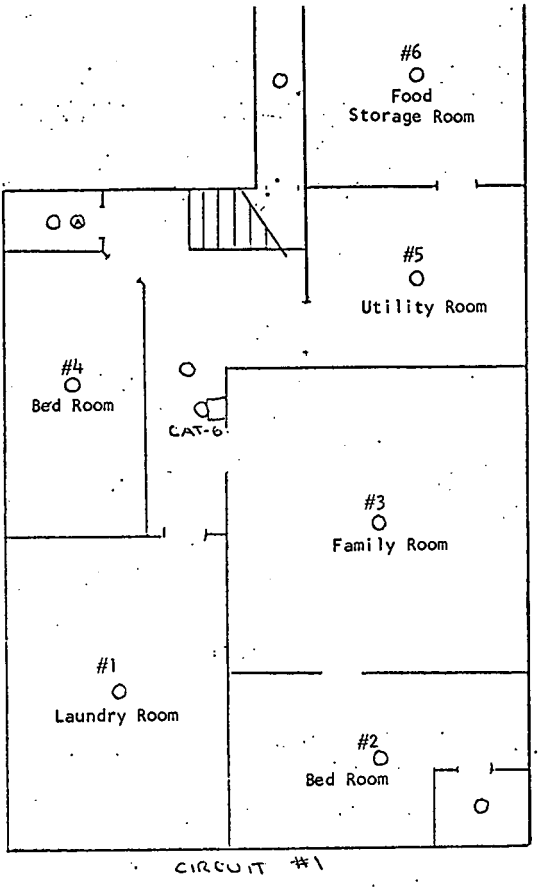
A - Wesley Hudson
B - Marriner Bone

* Indicates Deaths

SECOND FLOOR PLAN

SCALE 1/8" = 1'-0"

(Lil-Haven Nursing Home)



NORTH

#1
A - Laundry Room

#2
A - Bed Room

#3
A - Family Room

#4
A - Bed Room (Jack Monte Waldron)

#5
A - Furnace & Hot Water Heater Room

#6
A - Storage for canned and other food supplies

BASEMENT PLAN

SCALE: 1/8" = 1'-0"

(Lil-Haven Nursing Home)

Information relative to the admission of setting the fire, made by Thorvold Peterson during his interview at the Fairview Nursing Home, was furnished to State Fire Marshal, Robert A. Tanner, and Investigator, Steve Kennedy, by Dr. Bruce Walter, Utah Division of Health, Bureau of Medical Services, 72 East 4th South in Salt Lake City on September 15, 1971.

The above information was then furnished to Chief Ben Andrus, Fire Marshal, Fire Prevention Bureau, Salt Lake City Fire Department, who in turn notified Detective Ralph Whittaker of the Salt Lake City Police Department.

On September 16, 1971, Thorvold Peterson was interviewed at the Fairview Nursing Home by police and fire representatives at which time he furnished substantially the same information about his involvement in setting the fire as he had stated in the previous interview. An authorized complaint charging Thorvold Peterson with 1st degree murder was filed by Detective Ralph Whittaker on September 17, 1971, after which Peterson was taken into custody and transported by ambulance to the University Medical Center for psychiatric examination to determine his mental competency to stand trial on the charge.

ITEM 5. LETTER FROM B. F. ANDRUS, FIRE MARSHAL, SALT LAKE CITY, TO LEON R. DeKORVER, CHIEF, FIRE DEPARTMENT, LISTING RECOMMENDATIONS FOR INCREASED FIRE SAFETY, SEPTEMBER 27, 1971

FIRE PREVENTION BUREAU,
Salt Lake City, Utah, September 27, 1971.

LEON R. DEKORVER,
Chief, Fire Department.

SIR: Attached is a list of recommendations for increased fire safety in nursing and convalescent homes, schools, day nurseries, hotels, and apartment houses.

In making these recommendations, consideration has been given to the problem of trying to enforce lesser standards. A fire inspection of such items as doors being kept closed on stairways, locked exits, etc., is only valid on the day and at the time it is made. These recommendations are designed to build as much safety into the buildings as possible and to make these safety features self-policing.

With the present number of inspectors in the Fire Prevention Bureau it is impossible to police all places of public assemblage while maintaining our normal duties and responsibilities.

Respectfuly,

B. F. ANDRUS, *Fire Marshal.*

Enclosure.

CONVALESCENT AND NURSING HOMES

State will probably set up fire standards for these occupancies and these will be based on N.F.P.A. 101. However there are a number of items to be considered:

1. Rules have been more strict for non-ambulatory patients. The term non-ambulatory has generally been used in connection with the physical condition of patients. I believe that consideration should be given to mental condition also and that certain medications can change a person's mental condition.

2. Automatic Sprinkler systems should be required in all Convalescent and Nursing homes. These systems should be provided with water flow and tamper alarms connected with the Fire Department or an approved fire alarm company as outlined in Section 15–27–3, Revised Ordinances of Salt Lake City.

3. Door closers as specified in Section 3309, paragraph 6, Uniform Building Code, should be required on all doors in stairway enclosures.

4. Exit requirements should be as specified in Section 3318, Uniform Building Code, 1970 Edition.

SCHOOLS

Although enforcement of fire prevention standards in the public school system is almost an exclusive function of the State, I recommend the following:

That representatives of the Salt Lake City Fire Department meet with the Salt Lake City Board of Education and try to gain compliance with the provisions of Section 3317, Uniform Building Code, 1970 Edition. If this is successful, then the same section should be made mandatory for private schools within the city. School alarm systems should be connected directly to the fire department alarm system. That all present methods of fire protection in the schools be made to conform with the requirements of the Revised Ordinances of Salt Lake City, 1965 Edition.

DAY NURSERIES

Day Nurseries should comply with the same recommendations as schools except that no children should be allowed above or below grade unless the building is equipped with automatic fire sprinkler system.

APARTMENT HOUSES AND HOTELS

I recommend that all the provisions of Chapter 13, Uniform Building Code, 1970 Edition, be applied as the chapter requires. I would also like to point out that the exception providing for intumescent paint will create an enforcement problem in the future. Doors to stairway enclosures will also create problems unless automatic closers, connected to heat or smoke sensors, are installed.

Appendix 2

STATUS OF UTAH NURSING HOME INDUSTRY—1971

UTAH NURSING HOME ASSOCIATION,
Salt Lake City, Utah, October 19, 1971.

DEAR SENATOR MOSS: The Utah Nursing Home Association acknowledges the opportunity to add to your Subcommittee's recent hearing findings by submitting a statement documenting the events of the Lil-Haven Nursing Home fire.

The Association has no supplemental clarification on the events of the fire to add to the record of your Subcommittee, but enclosed is a six-month in-depth report on the status of the Utah Nursing Home industry we think you will be interested in.

Utah Nursing Home administrators again thank you for your concern for the welfare of our state's and the nation's elderly living in nursing homes.

Sincerely,

DON B. SEARLE, *UNHA President.*

Enclosure.

STATUS OF UTAH NURSING HOME INDUSTRY 1971

Nearly six months ago, the Utah Nursing Home Association (UNHA) decided that an accurate, well-documented and unbiased study of the state's nursing home industry was definitely needed.

The Association's executive board felt such an in-depth report would focus on the needs, problems and current conditions of those facilities, and assist the UNHA in its attempts to upgrade the state's nursing home industry.

Additionally, the UNHA felt that an honest report, neither a "whitewash" for, nor a "blind attack" against, the nursing homes, would better inform the mass media and through it, the general public.

In financing a comprehensive study, the Association hoped to encourage the mass media, and the public, to gain a better understanding of the strong points and weaknesses of the industry and to work constructively with the UNHA for improvement.

Realizing that the local media were not sufficiently staffed nor had the time or money for the project, the Association asked two local professional journalists, K. L. Young and R. C. Burnett, to use their reporting skills to properly investigate the nursing home situation.

Working over 250 hours at Association expense, the pair interviewed 95 nursing home operators, inspected their facilities from a reporter's standpoint, and talked with various state officials to ascertain their opinions and findings.

The following pages contain the uncensored, truthful findings of the two-man research team.

BASIC FACTS

There are 78,000 Utahns (1970) aged 65 and over, according to population projections. Current analyses of the health condition of the 65 and older population in Utah show that 4.7 percent require institutional care, which means that 3,700 elderly Utahns fit into that category, said the Utah White House Conference on Aging nursing homes task force.

There are, at present, 5036 nursing home beds at all levels in the whole system; 20 percent of these beds are occupied by patients under 65.

With a projected yearly net increase of the 65 and older population of 2630 persons, the yearly net increase in the number of beds required just for the elderly is 105, or 1050 beds between now and 1980, according to the task force.

Nursing Homes have twice as many female patients as male; the average age of all elderly patients is 81. All but 13 percent of the discharges are terminal and most of the 13 percent are really transfers to a different type of institution.

The task force determined that 46.7 percent of the aged in Utah nursing homes have a primary diagnosis of mental breakdown, commonly described as "senile brain syndrome."

Nursing homes were established for one purpose: to give proper care to individuals who, because of age or physical or mental infirmities, are unable to continue normal living patterns in society but don't require expensive continuous hospitalization.

In reality, nursing homes substitute for the family home of the person who requires continuous nursing care, and, in the pattern of patient care are placed between the patient's own home and the hospital.

Patient care, then, is basic to any discussion of the nursing home situation in Utah and should be the major consideration in judging and improving nursing home services.

Since many factors enter into patient care, the research team focused on various sub-topics, and its findings are categorized on the following pages.

Patient care in nursing homes is regulated and supervised by the Utah State Department of Health, under the direction of Dr. Bruce A. Walter. His department's responsibility is to implement and enforce the "Code of Nursing Home Rules and Regulations" adopted in 1953 in the 136 nursing home facilities in the state.

In a recent interview, Dr. Walter gave his impressions of the level of patient care in Utah nursing homes:

"Nursing home care varies from home to home; it varies from patient to patient," he said. "Care, oftentimes, is tied to the personality of the patient. Those patients that are difficult over a long period of time tend to get less tender, loving care.

"We have a group of 136 different types of facilities, and, for the most part, they are interested in providing good, quality care."

Presently, Dr. Walter's staff only includes two persons who are assigned to visit nursing homes. Additionally, they are charged with monitoring care in hospitals, residental care facilities and all other health care institutions in the state.

Admittedly, because of the limited size of his staff, "We can't really monitor the care with only two staff people. However, the Department of Health is receiving Federal funds now to 'beef up' the staff to four people," Dr. Walter said.

How many times, then, is a nursing home visited annually? "Homes are visited on the average of from one to eight or ten times a year, depending on the problems encountered," he said.

The state is striving to enforce more closely certain mandatory items and minimum standards outlined in the code for nursing home administrators. They are:

To insure that a facility is maintained, equipped and staffed to meet the nursing needs of the patients.

To provide for a safe healthful environment which is designed for and is conducive to good patient care.

To provide for rehabilitative and recreational therapy.

To encourage educational and training activities.

Nursing homes are divided into three broad categories: comprehensive, intermediate and personal care homes.

A comprehensive care home is staffed and equipped to provide under the direction of a physician, skilled nursing care—care which requires use of professional judgment based on knowledge of medical science—for convalescent or chronically ill, infirm or mentally ill patients who do not require the intensive care of a hospital.

Other services in such a home include administration of medicines which must be specially prepared and administered, as well as rehabilitative programs.

Minimum staffing requirements by shift are: morning, one nursing personnel (registered nurse, licensed practical nurse and aides) based on eight patients; afternoon, one per 16 patients; and night, one per 24 patients in homes for ten patients or more.

In addition, at least one registered nurse will be on duty at these homes from eight hours a day (for 10 to 48 patients) to 24 hours a day (for 73 to 104 patients).

Intermediate care nursing homes provide technical nursing care (care which requires selected nursing procedures in those circumstances where a professional degree of evaluative judgment is not required) for chronically ill, infirm or mentally ill patients.

Types of services offered in this type of home include help in walking, getting in and out of bed, assistance in bathing and other less specialized services as compared to a comprehensive home. When a physician prescribes care which is beyond the nursing care capability of this home, the patient must be transferred to a comprehensive facility.

Personal care homes are primarily socially-oriented. They provide such services as general assistance with grooming and personal care and preparation of special diets. Patients are capable of taking their own medicines, however, medicines must be kept in a locked medicine cabinet in the house.

When state teams inspect nursing homes, they actively seek "evidence" of adequate nursing care. Such evidence includes:

A written nursing care plan for each patient developed by physicians recommendations; good personal hygiene, such as clean, well-groomed hair, etc.; good feeding practices, ranging from self-feeding devices to use of dining room facilities; clean patient's rooms; knowledge, understanding and kind, considerate care; continuous effort to reduce bedfastness and incontinence; and that all medications be administered by a qualified person.

While conducting regular inspections of nursing homes, Dr. Walter's office devotes much time to investigating complaints and charges of "abuse" which are regularly directed against nursing homes in the media. Such broad, inflammatory terms as "deplorable conditions," "beatings" etc. have angered nursing home administrators and kept Dr. Walter's teams busy investigating for years.

"One of the very time-consuming parts of the job is checking out complaints—the very large part of which are spurrious. That's why 'Nader's Raiders' aren't very good because they don't understand the situation in nursing homes, Dr. Walter said.

"A very significant part of the complaints come from people who are fired, layed off or otherwise discharged. These are the lower-tier people who cause difficulties.

"One of the other sources of complaints come from families, themselves. These are largely unfounded, distorted or totally false—and they stem from the relatives' guilty consciences for having placed 'Mother' or 'Dad' in a nursing home."

In summation, he agreed that nursing home rumors are largely unfounded. "I don't think you can say there is any more abuse in nursing homes than in other types of long-term care facilities. In fact, there is probably a lower incidence of abuse in nursing homes than elsewhere."

Regarding alleged beatings or patient abuse, "Nursing home administrators are beaten more often by patients than vice versa. Beatings are extremely rare—and of little consequence. However, at least one administrator has been attacked by a patient with a hammer."

Nursing home administrators around the state are very sensitive about their apparent public image as being abusers of elderly people, and, like Dr. Walter, feel it is mostly unfounded.

"We have one or two homes that make the rest of us look like stinkers," said one operator. "I have not seen any abuse myself in a nursing home. However, what might constitute abuse to an onlooker might just be discipline, and entirely necessary," an Ogden owner added.

"The beatings are blown way out of proportion while the good deeds are ignored by the press," an Orem owner compained.

The Utah White House Conference on Aging this year studied the problems facing the state's senior citizens through many months of fact-gathering, problem identification and analysis.

While the nine-member task force on nursing homes analyzed many aspects of the overall situation, the committee unanimously agreed that "good quality of care is the most important issue.

"There may be some disagreement as to how this can be achieved . . . but all believe that Utah does not achieve as high a standard in all nursing homes as required for proper care of the elderly ill," the report noted.

"There is considerable evidence, on the national scale, of widespread abuse and fraud, as well as lax administration. There is no reason to believe that Utah is immune from such practices." (Task force recommendations to improve the level of care are contained later in this report.)

Obviously, if nursing homes are to provide the level of care required by law and human compassion, they must rely heavily on the state's medical practitioners. With a few notable exceptions, particularly along the Wasatch Front, the medical profession has cooperated well in advising administrators and prescribing the necessary care for nursing home residents.

In Salt Lake City, Provo, and particularly Ogden, some nursing home administrators have, in their own words, been confronted with a desperate situation in which they cannot get medical treatment for their patients. Most say, "It depends on the doctor. Some are willing to help and others aren't."

The administrator of one of Ogden's largest homes puts it bluntly:

"It's almost impossible for a welfare patient to get medical care. Doctors are violently opposed, and, as a result, welfare patients have a very difficult time getting a doctor.

"Dumping welfare patients is a game. The Hippocratic Oath is pretty well by the boards when it comes to welfare patients. Motivation for physicians is strictly financial. Their attitude toward the poor patient is: 'We don't want him.' "

The situation is similar in Provo. Said one angry administrator: "Our most difficult problem is trying to get a doctor when he is needed. The State Mental Hospital used to send help, but now the hospital has divorced itself from the nursing homes.

"Our only chance is to rush the person to the Utah Valley Hospital for emergency treatment since the hospital now has a doctor on duty at all times."

Another Provo administrator related the time a patient lost 22 pounds in one week for inexplicable causes. "When I called the doctor, he said 'I've got you on my list and I'll come out when I can.' We aren't trying to cover up; we want to be examined. Doctors don't have time and they don't want welfare patients."

On the other hand, doctors were generally complimented for their hard work and dedication by nursing home administrators in towns and counties outside of the more-populous sections of the state.

"The cooperation from our doctors has been wonderful. Because it is a small town, they really care about these people. That's why we can run a nursing home like it should be," said one in Roosevelt.

The much-publicized doctor shortage in rural Utah has none the less also affected care of patients in nursing homes. "The doctor situation is really unusual. There are too few doctors for the number of people in the country. As a result, they are entirely swamped. Since we are located near a county hospital, it would seem like the doctors could run right across the street to check our patients, but they don't have time," stated a southern Utah owner.

As stipulated in section five of the state nursing home code, "All patients shall be under the continuing care of a physician."

A patient in a comprehensive nursing care facility must be seen by his physician and a progress note entered at least every three months. A person in an intermediate care home must be examined every six months, while the personal care individual is only required to have an annual check up, according to state laws.

Aware of the problems between some nursing homes and doctors, Dr. Walter said, "The problems of these patients are not great medical challenges. Their physical changes are minimal. Therefore, doctors place their time where they feel it is better needed.

"We are, however, stepping up requirements for visitation by physicians. Physicians, to a degree, might not be fulfilling their obligations."

He noted that for a time the state was considering using new doctors who hadn't established practices yet and semi-retired physicians. But, he said, Federal pressure and "the enormous cost of malpractice insurance forced the shelving of that idea."

But why don't some doctors cooperate with nursing homes in conducting regular visits as required by state law? As one doctor stated, "Reimbursement by the state for time spent with welfare patients is inadequate to meet my needs." While some doctors may be reluctant to make regular visits because of financial reasons, at least one prominent doctor, Dr. Victor Kassel, noted geriatric

specialist, feels the reluctance may stem from inefficient conditions in nursing homes.

"Doctors don't want to visit nursing homes for a number of reasons," he stated. "Too many of the persons working there are incompetent. For example, a doctor takes time to visit a home and the person left in charge by the administrator isn't expecting him.

"Then, the aides have a hard time finding the patient's medical chart, or even the patient himself, since sometimes the aides don't know the names of the patients and are unable to direct the doctor to the individual he is to examine.

"When he finally locates the patient he sits down on a chair that has been urinated upon. Additionally, lighting in most nursing homes is made for seduction rather than for any kind of examination.

"Doctors dislike nursing home visits because everything is against them. It takes then ten times as long to accomplish anything," he concluded.

While a doctor's supervision is vital to proper patient care, Dr. Kassel strongly felt that "the level of patient care is dependent on the nurses' aides," a situation that has troubled nursing home officials for some time.

Basically, the problem, as most nursing operators see it, is this: Competent, trained help is very difficult to find due to minimum pay scales and the ability of hospitals to pay higher wages.

"It is the lousiest job in the whole world," Dr. Kassel stated. "The level of care does not depend on the nursing supervisor nor the doctors; it is the responsibility of the personnel who come in contact with these people day after day. I wouldn't do it."

Commenting on the problem, Dr. Walter said, "The problem in hiring good help centers around the question: 'Who wants to do the job?' Secondly, these aides are on the low rung salarywise. Third, are these people interested in the job and are they able to secure the educational background necessary to do it efficiently?"

"Nursing homes meet Federal minimum wage requirements for non-professional employees, but because of increased costs, inflation, higher wages and normal fringe benefits, cannot be afforded," a Utah Nursing Home Association bulletin pointed out.

"Nursing homes have increased salaries of professional nursing employees, but because of inadequate state payments, they still cannot compete with hospitals for adequate nursing personnel," the bulletin added.

Nursing aides are vital in the operation of a nursing home. Their duties range from cleaning the physical plant to conversing, entertaining and generally keeping the morale of the patients high.

"You can get anyone to babysit, but it's hard to get someone to get involved with the patients," a nursing home operator from Salt Lake's Avenues' section noted. "You cannot work with these people very long if you're not dedicated. Sometimes the patients are very nice, other times very obnoxious," a Brigham Young University student aide pointed out.

Owners of homes in rural Utah almost unanimously indicated that finding and employing good employees was not a problem for them. This apparently stems from the fact that jobs are scarce in their areas, and that many of the aides have friends, relatives or other close acquaintances in nursing homes.

Reports of abuse often result from poor aides: the lack of patience on their part and their inability to adjust to a difficult situatiton in dealing with people who, according to Dr. Walter, "are basically a depressed group, and they express it."

"Philosophically, the patients know they are on the downhill run. They are basically a depressed group, and they express it."

Mrs. Marie B. Young, administrator of Salt Lakes Barlow Nursing Home, noted: "It is very difficult to find competent help. Out of 20 applicants, we usually only find one or two that are up to our standards. We recently had to let one aide go because she lost her temper with a patient."

Commenting on the same problem, Morris Willard, administrator, Central Utah Convalescent Center, said, "To have someone working in a place like this, day after day, and still have empathy requires a special talent. Certain patients try people's nerves."

Another related problem-area is the high rate of employee turnover. "We have great turnover in help even though we have vacation and benefit systems. The UNHA should work towards curbing the transient labor problems. Some

employees drift from one home to another seeking work. They will take a job at one home, but as soon as conditions aren't just right or they don't get a certain day off, they're gone and never again seen," Sister Thelca, administrator of Joseph Villa, added.

Several other nursing home operators along the Wasatch expressed the same problem, including David H. Dunn, Jr., administrator, Wide Horizons, Ogden, who commented: "Although the employee turnover problem is not as great as it used to be, I would estimate that my staff has turned over at least four times in the past year."

While a constant employee turnover causes the normal administrative headaches of staff juggling, hiring new help, etc., it hurts the patients more in terms of psychological adjustment to a new face, new attitudes and new treatment. Under the auspices of the UNHA, a nurses' aide course was instituted at Utah Technical College. Individual homes paid for the girls' tuition and offered pay incentive to encourage their participation.

However, both Dr. Walter and Dr. Kassel were of the definite belief that such training needed to be expanded to include all nurses' aides. But as long as nursing home reimbursement is merely marginal, nursing home officials will be reluctant to subsidize such programs, knowing that their pay scales aren't good enough to keep trained personnel from merely taking their newly learned skills to hospitals.

NURSING HOMES AND THE COMMUNITY

What is the role of nursing homes? How do they relate to today's increasingly complex society? Are they "warehouses for the dying" as some charge; or are they places "to grow old gracefully" as nursing home officials contend?

The average citizen's opinion of nursing homes isn't good, as indicated by most surveys. His viewpoint is essentially that which has been communicated to him in the media: "beatings," "deplorable conditions," "filth," "senility," "incontinence," "loneliness," etc. are impressions of nursing homes which increasingly trouble people as they begin to age, as their health begins to deteriorate, and as their children begin to find them somewhat burdensome.

While substandard conditions do exist in some nursing homes, Utah nursing home officials defend their industry as having licensed facilities "designed for the finest in care for the elderly, with total programs and space requirements consistent with patient needs."

After President Nixon recently called for a cutoff of Federal funds to, and closure of all "substandard nursing homes," Lee W. Dalebout, executive director of the UNHA, sent the President a letter explaining that the 5000-bed, long-term care industry in Utah was "in complete accord" with the President's goal of eliminating substandard facilities.

"Elimination of the comparatively few substandard facilities in this state is proceeding progressively through a combination of attrition and regulation by the Association and the state," Dalebout noted.

He expressed concern about "widespread publicity" given to statements by the President that many nursing homes are "warehouses for the elderly" and are overcrowded and understaffed.

"While it was readily apparent to nursing home officials that your criticisms were in reference to a small minority of substandard homes, the media in our area interpreted them to be generalizations directed at the entire industry," Dalebout wrote.

The nursing homes in Utah have accepted the challenge and are daily improving their knowledge and skill in helping the aging to be old gracefully, an Association brochure points out.

Realizing that fear of old age, physical infirmities, disease and dying cause many people to lash out at nursing homes as a hated symbol of these harsh realities of life, nursing home operators feel "the greatest challenge our nursing homes face is to help the patients understand the transition from life in their own homes to the nursing home," the brochure adds.

Dr. Kassel feels nursing homes are "absolutely necessary" in today's society.

Describing modern homes as "two generations-oriented," Kassel said young parents can't be "expected" to care for themselves, their own children and for the "third generation," the grandparent(s). "The child has the obligation to see that aging, sicky parents get good care but not to provide that care himself," Kassel stressed.

Such older people need a place to stay and receive the proper care. "Many patients go to hospitals that could just as adequately be given proper care in a nursing home at a fraction of the cost," Kassel added. Choosing an expensive hospital over a nursing home offering adequate care is due to "an aura of mystique which still surrounds hospitals," he said.

These people (nursing home administrators) do a superb job; they all want to do the job. They are still handicapped, however, by the reputation nursing homes have among nurses and the public," he said.

Among the recommendations Dr. Kassel had for improving the nursing industry were:

Better training for nurses and aides. "Nursing Homes are going to have to pay their personnel for taking such classes" to increase their level of sophistication and their ability to give better care to patients.

Converting nursing homes to a "non-profit" basis. "There should be no profit in sickness. Administrators are entitled to make reasonable incomes but not outlandish profits."

Dr. Walter, while lauding the industry as "basically doing a fine job," listed several recommendations to "further improve the industry":

More training of administrators through clinics, seminars, advanced education, etc.

Comprehensive training and definite requirements for nursing personnel.

"Adequate" reimbursement to nursing homes for services rendered.

A better public relations-type activity to explain the role of nursing homes in society.

Greater family involvement where possible "which would cut down on some of the problems of proper patient care."

This year, the Utah White House Conference on Aging issued a report on the status of the aged in Utah. The conference issued the following recommendations:

1. That state law be amended to allow more than one person to receive room, board and care in the home of a non-relative; that home health services be extended throughout the state; and that other alternatives to nursing home placements such as daycare centers be developed with all possible speed.

This conclusion was reached after studying "the many documented cases of misplacement—the slightly ill treated in intensive service facilities, the very ill treated in custodial surroundings, the mentally alert living with the mentally ill, the treatable patient untreated because the facility is not properly equipped."

2. That in-service training programs be established; including lectures by specialists in aging; that successful completion of such a course be required of all aides, charge nurses and other staff.

This recommendation was made after task force members received reports from patients or relatives about dirty linens, bad food, inhumane and/or indifferent aides, overuse of tranquilizers, inadequate drug labeling, and casual supervision by doctors in certain nursing homes.

"The nature of man being what it is," the task force report read, "bad reports linger in memory, and often crowd out good reports. Certainly, such deplorable conditions do exist and must be eliminated, yet many of the nursing home administrators try to provide adequate and sanitary care."

Related proposals for improvement include widespread use of volunteer visitors recruited from church groups and senior centers; urging patients to help each other; developing "patient committees to funnel grievances and suggestions to administrators; developing regular, planned recreational and occupational therapy programs.

3. Classification of care must be identified so as to determine specific staff and facility requirements; mental retardation centers, mental health centers, rehabilitation centers, alcoholic detoxification centers, drug addiction centers, residential care, and other specific treatments.

"One of the most frustrating and baffling problems in the nursing home system is the present practice of placing patients in an 'available facility' rather than the 'specialized facility' required by a patient.

"Doctors, either through ignorance or indifference, may order that a patient be admitted to a particular home because (1) it is properly certified for Medicare reimbursement; it is convenient for the doctor; (3) it is convenient for the family; or (4) it has an available bed.

"None of these reasons is necessarily improper, yet what the patient needs is rarely given adequate consideration. Mistakes in placement are common."

4. *A committee should be formed immediately to analyze the deficiencies of the Utah State Manual for Nursing Home, to rewrite said manual, upgrading its regulations and requirements, in regard to licensure and fiscal control, and to prevent such a revised version for office action.*

5. *The staff of the state regulatory agencies should be immediately expanded to include a nutritionist and mental health expert, so that requirements of the present manual may be effectively enforced.*

Both of the above recommendations were made by the task force because "all members want certification standards and qualifications strictly and uniformly enforced, even if it results in fewer certified beds."

6. *Federal authorities should rewrite the Medicare legislation to develop common nomenclature and correct deficiencies.*

7. *All persons who are involved in the health care industry in Utah must be reminded that the elderly ill need compassionate and efficient service.*

The task force stressed "the great need for an education in humanity directed toward hospital placement workers, doctors, nurses, social workers, nursing home staff members, and above all, the general public.

They urged "that churches become involved either by holding weekly worship in nursing homes, or that the churches invest in minibuses to transport the less seriously ill patients to churches of their choice.

"Nursing homes do not want to be contemptuously known as 'bed sore factories,' and the nursing home owners should involve themselves in positive public relations work," the report added.

MEDICARE

Strongly denouncing "the hoax perpetrated on the elderly by the Medicare Program," the American Nursing Home Association and its Utah affiliate, the UNHA, withdrew their official support of the Medicare Program for Extended Care January 1, 1971.

The Federal program, implemented 1966, has had a stormy history in Utah. Since its beginning a maximum of 35 nursing homes have been involved in the program. Presently, 20 homes are participating, the State Health Department reports. The UNHA declared in January: "Vital health care for the elderly has been denied them by the government, and the intent of Congress when it passed the Medicare Law has been neglected by the government agencies which administer the program."

Lee W. Dalebout, UNHA executive director, said: "Utah nursing homes have long been disenchanted with the Medicare Program. For the past two and one-half years many of Utah's better nursing homes have withdrawn from the program. Many more are contemplating withdrawing. Promises of Medicare far exceed performance."

Citing Social Security Administration published statistics which indicate a steady decline in utilization of available extended care approved beds for the elderly, the American Nursing Home Association pointed out, "less than five percent of the 340,000 certified Medicare Extended Care beds are being utilized. Such limited and restrictive use has resulted in a national failure to achieve a less costly alternative to hospital in-patient services as intended by Congress."

"We have been faced continually with Federal retroactive denials on service claims," Merlin A. Reeder, UNHA president and administrator of Highland Manor, a Salt Lake City nursing home, stated. He cited this criticism as one of the main causes of withdrawal from Medicare by Utah nursing homes.

Reeder, whose nursing home is one of 15 that have withdrawn from the Federal program, said that in its first year in the program, one Salt Lake home received almost $30,000 in retroactive denials.

Blue Cross Blue Shield, elected by nursing home administrators as Medicare fiscal intermediary for Utah, overruled many decisions of the state's Medical Utilization Review Team and some private doctors in determining whether Medicare should pick up the tab for many of the elderly sick.

The case of the $30,000 in retroactive denials was taken to court. Blue Cross Blue Shield was ordered to pay the nursing home in full.

Nursing home administrators, whose homes have dropped out of the program, charge that there is "no consistency" in determining whether a patient is eligible for Medicare. Those administrators who remain part of the program believe

that there "is less confusion now than in the past" and all wait for a better Federal program to evolve.

The other major Medicare problem has been "unrealistic cost auditing," according to Reeder. The Utah nursing home industry, which is for the most part a private profit-motivated industry, is forced by the Medicare program to operate at cost or less than cost. Nursing home officials complain that Medicare does not provide for a realistic return on a nursing home owner's investment.

The Utah White House Conference Planning Committee on Aging in cooperation with the Utah Division of Aging has noted problems and suggested changes in the Federal program which deal with nursing homes. They point out that there is no common nomenclature describing uniform standards requiring for Title XVIII (Medicare) and Title XIX (Medicaid) certified nursing homes. Federal legislation requires that the principles of utilization review and cost-plus reimbursement be maintained, yet there is no federally mandated mechanism for implementing the legislation.

Utah has developed its own mechanism, which so far has pleased neither the state authorities nor the nursing home administrators nor has met the needs of patients. The two groups recommended that Medicare legislation be rewritten, that common nomenclature be developed, and that the mechanisms of utilization review be defined

REIMBURSEMENT

"The UNHA is only asking for an increase in welfare payments that will meet higher costs, assure higher standards, and create a reasonable return for home owners."

That plea was made by UNHA Director, Lee W. Dalebout, last January to the State Legislature. After several stormy committee meetings, the Legislature did grant the nursing homes an increase in payments.

In August, 1970, Dalebout, speaking on behalf of the Association members, warned Governor Calvin L. Rampton that nursing home operators would refuse to care for the 3500 state welfare patients if some increase was not forthcoming.

In arguing his case before the state solons, Dalebout cited the following:

Government payments to hospitals for welfare patients increased from $22 to $42 from 1965 to 1971, while welfare payments to nursing homes only went $5.30 to $7.

"Hospitals have adjusted their rates to meet increased costs while nursing homes are forced to juggle inadequate receipts to maintain operations because of their large welfare patient load, amounting to 63 percent of all patients.

"Nursing homes are fighting a losing salary battle with hospitals for the most competent and skilled nursing personnel. Upkeep and remodeling, services to residents, and increased care suffer because of inadequate government care payments," Dalebout noted.

Backed by Dr. Walter (see earlier comments), the UNHA's requests were met by the Legislature and most nursing home operators indicated that the welfare increase would enable them to compete more favorably with hospitals for personnel and perform needed maintenance on their facilities.

RECREATION AND REHABILITATION

In some nursing homes color television is the ultimate in patient recreation. In other homes, television is only an excuse.

Two basic attitudes toward recreation seem to flourish across the state: (1) "These patients simply want to rest, and that is what we allow them to do. Too many nursing home administrators force patients into activities which they really don't want to do." (2) "We encourage regular recreational activity for all those patients who are physically capable."

One comprehensive care facility director in Salt Lake City can boast of the services of his full-time recreational therapist. Forty Salt Lake area homes call on the services of a local recreational therapy company which provides transportation for nursing home residents to shows, dances, outings, and other activities, and sends its personnel into homes to supervise game, handicraft, and visit personally with patients. Outside Salt Lake County, administrators must devise their own recreational activities. Some do an outstanding job, others do very little.

Activity programs are scheduled as often as every day in some homes and as infrequently as once or twice a month in a few homes. Bingo seems to be the most "popular" game played by nursing home residents. Card games, handicrafts,

walks around the block, sewing, singing, worship services, and lots of television watching are other widespread activities.

Three administrators interviewed made known that they go an extra 500 miles. They pack food, clothing, and their patients into mini-buses and travel to such far-away destinations as Mexico and Canada.

State health officials are vigorous promoters of recreation. "We essentially tell administrators they must provide recreation," Dr. Walter said.

Involving patients in recreation is made difficult at times by their families, many administrators state. A son or daughter of a patient will say, "Let her rest; mother should be in bed."

Many families have expressed amazement at mother's handicraft skills even though she is in her late eighties. Some families fail to see how coloring in a child's coloring book helps their mother. Administrators report that a few families are embarrassed or resent their father actually taking a "crayon" to hand. Nursing home personnel are quick to point out that all activity leads to better health and attitude.

Church and civic groups volunteer time and talents to conduct regular worship services and entertainment programs for those homes desirous of their help. But in rural areas across the state, volunteer services, television watching, and an occasional Bingo game are the total nursing home recreation program.

"Activity and supervision are the keys to proper care and rehabilitation," according to Kent Beagley, administrator of Rest Haven Nursing Home, Lindon, whose 34 women patients are a few of hundreds that have been placed in nursing home homelike atmospheres over the past few years as part of the state's Community Health Care Program.

The state is only oriented to the medical needs of patients and not to the mental needs," Beagley said. "That's why more emphasis is not put on rehabilitation."

"And in most cases people don't come to nursing homes when we can do something for them. They usually come when we can do very little for them. It becomes just a matter of custodial care," David H. Dunn, Jr., an administrator of Wide Horizons, Ogden, added.

Because of the difficulty administrators have in finding and retaining skilled employees, few nursing home personnel take the time or effort to work with patients on a personal level. Only a small number have the know-how to help patients enjoy activities and few have the desire to give patients more than a minimum amount of attention.

"Nursing homes are looked upon by most people as a place to go and die, not as a place where rehabilitative aid is given. But we hope to move more into the rehabilitative area in the future," Mrs. Fay Case, administrator, Fay Case Nursing Home, stated. "As government recognized the need and as much emphasis is placed on the mental needs of patients as on the medical needs, then more nursing homes will be able to do rehabilitative work."

APPEARANCE

Although some people are wise enough not to judge a person's character by his attire, few people look further than a nursing home's front porch before judging the type of care that is given inside.

Every nursing home administrator interviewed believes "nursing care is the most important criterion in judging a nursing home." Granted, it is the most important criterion. But certainly the grandiose appearance of the Hotel Utah leads one to expect extradordinary room service.

Judging nursing home facilities and nursing care by home appearance has been done and is being done by the public and the mass media.

Only 31 of the state's 136 facilities were built originally as nursing homes, Utah Department of Health statistics show. The overwhelming majority of homes are converted one-family homes, motels, hospitals, and rooming houses.

The administrators of many of the converted buildings have been reluctant to convert their homes to sterile hospital-like facilities. "There are so many pros and cons for larger and smaller homes. However, we must not put nursing homes in the category of hospitals—it will simply cost the public too much," one Orem nursing home owner said.

"You can't say they're really homes. We have received more good comment concerning our hospital-like type of home. Relatives like to see the patient in a sterile facility which looks very much like a hospital," a Provo administrator said.

"Nursing homes should be homes—not nursing hospitals. If you put our patients in their own homes, they would have terrible problems. But they don't need hospitalization," a Salt Lake City administrator said concerning his custodial care patients. "If I upgrade the home so much that it becomes a stainless steel hospital, then I lose my effectiveness. Most of my mental patients have been in hospitals for most of their lives. Isn't it time that they have a home?" he questioned.

How important is external appearance? Certainly it is more important to some onlookers and nursing home owners than to others. Landscaping and external facility maintenance range in condition from poor to excellent with at least 50 of 89 homes visited being graded from "good" to "fair." Eight were rated "poor" while 17 were found to be "excellent."

Inside, high ceilings, narrow winding hallways, and kitchens with poor ventilation, are not conducive to easy maintenance. Incontinent patients cause continual cleaning problems for nursing personnel. Unless patients are constantly observed, furniture and other fixtures are damaged and incidents due to patients' inability to control excretory functions, occur.

Odors, due to incontinence, are constantly fought by nursing personnel. Some with little success. Even the newest facilities are plagued with the problem. In older homes without modern construction, cleaning chores are long and hard.

"Administrators in the converted, older nursing homes do a tremendous job. There was an effort at one time to drive out these smaller homes. But, these people provide a needed type of nursing care," Dr. Kassel concluded.

FIRE STANDARDS

Utah nursing homes are better prepared for fire than those in most states, Utah Fire Marshal Robert A. Tanner believes.

"Many Utah homes have installed ceiling sprinkler systems. Others rely on elaborate fire detection systems in emergencies," the fire marshal explained.

He stated that the Utah Nursing Home Association (UNHA) has been "cooperative in its approach to the fire problem."

A few small nursing homes without sprinkler systems or detection equipment, most of which are located in the state's three largest cities, have direct lines to fire departments, Tanner noted.

Nursing homes located in rural areas are probably better prepared for fires than those in larger cities, he said. "Many rural homes have installed the sprinkler systems."

The time will come when all nursing homes will be required to install sprinkler systems for emergencies, Tanner predicted.

The fire marshal warned that although sprinkler systems will probably be required in all homes, regardless of size, "They are not a fire panacea."

A combination of detection and sprinkler systems is today's best method of retarding fires, he added.

While all nursing home operators agreed with Tanner that patients must be adequately protected, many felt mandatory installation of sprinkler systems, which cost in the vicinity of $10,000 to install in an average-size home, were too costly and would force many of the smaller homes out of business.

While larger homes have the patient volume to defray the cost, many personal care facilities, which house anywhere between 10 and 25 patients (mostly welfare), simply wouldn't have the revenue to stay in operation.

Smaller operators argued that early-warning detection systems and their generally close proximity to fire stations would enable their patients to be protected. Most of their patients, it was stated, are ambulatory and would be able to exit through designated fire escapes.

Presently, nursing homes which can call on the services of paid, on-duty fire departments in times of emergency fulfill state requirements if they have a fire detection system installed or if the home is constructed to permit a minimum of one-hour fire escape time for nursing home occupants, Tanner explained.

He stated he has an excellent working relationship with the UNHA and "we are working together to find a mutual approach for meeting the fire standards."

ROLES OF FAMILY AND THE PUBLIC IN NURSING HOMES

Mrs. X, a patient in a Salt Lake nursing home, was brought there by her family after she became "totally uncommunicative, incapable of caring for herself, and too much of a burden," in the words of her son-in-law.

Her hair was unwashed; body odors made her mere presence offensive; and her only communication was an occasional temper tantrum.

After several months of psychological and physical rehabilitation, Mrs. X told nursing personnel that she had been locked in her son-in-law's back room for two years.

It has been "several years" since her family came to visit her . . .

"The leading citizens in our community have never set foot in our nursing home. Many people just refuse to come in. Yet, they read adverse publicity and make false assumptions. We're proud of our home, and we're striving to create understanding."

A man approached the back door of a nursing home unnoticed. He stood there quietly, listening, without ever announcing his presence to nursing home personnel. Hearing screams, and upon being discovered, he demanded, "What are you doing to your people in there?"

He then was shown the television, around which the patients were seated. A show, involving a screaming heroine, was being heartily enjoyed by all.

An Ogden nursing home was closed after it was verified that the administrator had beaten a patient.

All of the above cases are fact; they illustrate the great need for greater involvement of the family, and the public as a whole in nursing home care of the elderly.

Dr. Kassel puts it bluntly: "The public has never done anything constructive for the nursing homes."

Despite liberal visiting hours in most homes, frequent open houses, and personal invitations, the public, in the opinion of administrators, has been content to form its impressions of the Utah nursing home industry from sensational media stories about "a few bad homes."

Almost unanimously, nursing home operators expressed enthusiasm for visits by state officials, city and county leaders, as well as doctors, the news media, and most importantly, the families of nursing home patients.

In placing a patient in a nursing home, the family plays a vital role in assuring the future happiness of that person in the amount of time it takes in finding the right home.

"The physician plays a major role in the proper placement of patients," explained Dr. Walter. "However, the family should decide whether or not the home under consideration is one the family member will like. Does he need a "homey," a "semi-institutional" or "hospital-like" facility. Secondly, the family should evaluate who's running the home.

In deciding on a particular home, the family should use their "five senses," according to A. Raymond Brey, administrator of Birdie's Nursing Home, Salt Lake City. He should look around at the physical conditions to see if the home is clean, neat, well-painted, etc.; he should sense whether the air is clean or odor-filled, an indication of whether the home is sanitary or not; his ears are to determine if patients are happily engaged in conversation or sullenly staring into space; his sense of taste should be used to find out the quality of food being served, and so on.

It has been suggested that families be required by law to care for their older members. While most administrators felt this was too extreme, there was general agreement on one principle: *if families visited regularly, talked with their loved ones, and then took time to review the overall situation with the nursing home supervisor, cases of abuse, improper restraint, over-tranquilization, poor diet, etc. would be detected and corrected.*

"I have patients who haven't had visitors for months and, in some cases, years," said Mrs. Fay Case, nursing home administrator and member of the UNHA executive board. Where family visits are frequent, adequate care can be assured, she noted.

"If the family assists us in learning about the personal habits and needs of patients, we can help the patient adjust much more quickly to the nursing home environment," Mrs. Case said.

"Nursing homes were not created as a substitute for the family, but in many cases, this is what has evolved," Mrs. Case added.

However, if the family and public are to become more involved in nursing homes, Dr. Walter cautioned, they must be made aware of the numerous problems and gain an understanding of them. "People do not understand how nursing homes work and they lodge complaints" . . . (most of which) "are largely unfounded, distorted or totally false."

Appendix 3

REPORT ON THE HONESDALE, PA., NURSING HOME FIRE OF OCTOBER 19, 1971

NATIONAL FIRE PROTECTION ASSOCIATION,
Boston, Mass., December 8, 1971.

DEAR MR. HALAMANDARIS: I was recently asked to send you a copy of our report on the Honesdale, Pennsylvania nursing home fire of October 19, 1971. Attached is a copy of this report as we plan to publish it in the January 1972 *Fire Journal.*

If I can be of further assistance to you, please advise me.

Sincerely yours,

CARL E. PETERSON, *Manager, Fire Record Department.*

Enclosure.

GEIGER NURSING HOME

CARL E. PETERSON, MANAGER

NFPA FIRE RECORD DEPARTMENT

On October 19, 1971, all 15 elderly residents of the Geiger Nursing Home perished when a fire swept through the facility. The Geiger Nursing Home, which was located in Texas Township, a small community in the northeast corner of Pennsylvania, was licensed for 18 patients; but three beds were not in use. All but one of the patients, who ranged in age from 73 years to 92 years, were ambulatory.

The original building was a two-story wood farmhouse. In 1959 a 43-foot-by-29-foot wing was added and the facility was converted to a nursing home. The new wing contained five patient rooms (Rooms 1, 2, 3, 9, and 10 and a nurses' station. The kitchen, the dining room, the TV room, and a bathroom were located on the first floor. The remainder of the farmhouse was used as living facilities by the owner.

The 1959 addition was a flat-roofed one-story frame structure. The interior partitions were ½-inch gypsumboard on two-by-four-inch wood studs; the exterior walls were two-by-four-inch wood studs with ½-inch gypsumboard on the interior and wood sheathing and asbestos shingles on the exterior. The exterior wall spaces were insulated with glass fiber. The ceilings throughout the addition were ½-inch gypsumboard fastened directly to the two-by-six-inch ceiling joists. In the patient rooms the interior finish was ¼-inch prefinished plywood paneling on the walls, paint on the gypsumboard ceilings, and linoleum on the floors. The corridor and nurses' station had paint and gypsumboard walls and ceilings and vinyl asbestos floor tile.

In 1965 a second flat-roofed one-story addition was constructed, which gave the building basically an L-shaped appearance. The newer addition was 76 feet long and 28 feet 10 inches wide. It contained five patient rooms (Rooms 4–8, two bathrooms, and a utility room. The utility room contained a washing machine, a commercial gas-fired clothes dryer, a plastic sink, and miscellaneous stored cleaning and floor maintenance equipment. The interior partitions in this 1965 addition were ¼-inch prefinished plywood paneling nailed directly to two-by-four-inch wood studs. The exterior walls were ½-inch insulation board on two-by-four-inch wood studs covered with aluminum foil and prefinished pressed wood siding. The interior finish of the exterior walls was the same prefinished ¼-inch wood paneling used elsewhere in the building. The ceilings throughout this section were ½-inch woodfiber tile fastened to one-by-three-inch furring strips, which in turn were fastened to the two-by-six-inch ceiling joists. The floors throughout were covered with vinyl asbestos tile.

In both additions there was a nonfirestopped area between the ceiling joist and the roof rafters. At its highest point it was a space of about 10 inches (the roof sloped very slightly to provide drainage).

All the doors in the building were hollow-core. The door openings to patient rooms in the 1959 addition were 42 inches wide; the door openings to the patient rooms in the 1965 addition were 48 inches wide.

Three patient rooms had one window and the remaining seven had two or more. The windows were double-hung wood sash 24 inches wide by 46 inches high. Each window had a triple-track combination aluminum storm window on the exterior. The clear width through the storm window was 23½ inches. The interior sill height of the windows was 27 inches, but on the exterior the distance from the sill to the ground varied from three feet four inches to eight feet two inches. The two additions had three exterior doors, each five feet wide, which could be used in evacuation of the building. A door near each end of the corridor in the 1965 addition led directly to the outside. After passing through one of the doors, one had to travel down a 59-inch-wide wood ramp 22 feet long to the ground level. The second exit was directly at ground level. The third exit was from the corridor of the older addition through an enclosed porch to the outside. The building had no automatic sprinkler system, no fire detection system, and no evacuation alarm.

The one licensed practical nurse on duty the evening of October 19 arrived at work about 2:30 pm to work the three-to-11 shift. During the afternoon and early evening she carried out her routine duties, which included feeding the patients their evening meal, administering medication, and preparing the patients for bed. On this evening the patients had started going to bed at 6:00 pm and reportedly all were in bed by 7:30. During the evening the nurse washed some patient clothing and around 7:30 pm she placed that clothing in the clothes dryer and set the dryer to operate approximately 30 minutes. She then continued with other duties in other sections of the building, including the kitchen.

Around 8 pm she was at the nurses' station, completing the records of medication given to the patients, when she heard glass break in the vicinity of the utility room and went to investigate. As she reached the point where the corridors of the two additions joined, she looked toward the utility room and saw heavy smoke at the end of the corridor. She tried to rouse the patients by shouting, and she entered most of the patient rooms in an unsuccessful effort to awaken them (she later admitted that all the patients had been given sedatives or sleeping pills when they went to bed—which would account for her inability to rouse them). On returning to the nurses' station she dialed the Fire Department.

After two unsuccessful attempts to reach the Fire Department, she hung up and tried again to rouse the patients. By then the corridors were becoming heavily filled with smoke and heat from the fire. Realizing she could do nothing alone, she left the nursing home and ran about 1,000 feet to the nearest residence, which was owned by the daughter and son-in-law of the owner of the nursing home. The Fire Department was called from there, and the son-in-law immediately went to the nursing home to attempt rescues. When he reached the nursing home, however, he could not get inside, because of the smoke and heat, and all he could do was to try to rouse the patients by breaking windows and shouting.

The Honesdale Fire Department was the closest department and the one that was called. It is a volunteer department with four pumpers. As the fire was outside the corporate limits of the town, local ordinance prohibited the sending of more than three of the four pieces of apparatus. The first-due piece of apparatus was on the road and within a mile of the facility when the fire call was received. It responded promptly, as did the fire chief and several officers who were in the station at the time.

Arriving fire fighters found flames coming from the windows and the exit nearest the utility room, which was at the rear of the building. They entered first through the old farmhouse section and from there entered the older patient sections. Their attempt to remove the first patient they located (in Room 1) were futile, as the patient was restrained in bed, a fact not readily evident in the dark, smoky conditions. Using water from a hand line to cool the area, they advanced to another room (Room 10), where they were able to carry the patient outside, but that patient was already dead. Fire fighters on the outside found a patient in Room 2 on a bed near a window and removed him through the window. He too was dead. Those patients were both in rooms in the older section of the building, rooms that after the fire showed no real signs of fire damage other than from heat and smoke. Additional hose lines were placed into operation at the exit locations

in the newer addition and fire fighters eventually contained the fire enough to permit access to all parts of the building. What they found was not a pretty sight. All the remaining 13 patients were dead.

In trying to determine the cause of this fire, investigators concluded that some time before the time the nurse heard glass breaking and discovered the fire, one of the baffles or tumblers inside the drum of the commercial clothes dryer had broken loose and had begun to tumble around freely inside the drum. This baffle was triangular in shape, 23½ inches long and 5¼ inches high, and it weighed several pounds. Apparently while it was being tumbled, the baffle became lodged in such a way that it prevented the drum from continuing to rotate, thereby causing a belt pulley on the same shaft at the rear of the dryer to stop rotating also. The electric motor that drove the belt continued to turn; and all evidence points to ignition of the belt by friction heat generated when the pulley on the motor rubbed against the stopped belt.

The belt and the pulleys were enclosed in a sheet metal guard to prevent persons or articles from becoming entangled in the machinery. The enclosure ran vertically up the back side of the dryer with an open top about 2½ feet below ceiling level. When the fire started, the enclosure acted as a chimney and directed the fire against the wood-fiber ceiling tile in the utility room.

There was no door on the utility room and there were no doors or subdivisions of the corridors in the building. The fire developed in the immediate area of the utility room; the glass the nurse heard break was probably in the window of the utility room or in a window immediately outside the utility room at one end of the corridor. As the fire developed it spread along the wood-fiber ceiling tile and the prefinished plywood wall paneling in the corridor of the newer addition. It also swept into the corridor of the older addition. Since the doors to many, if not all, the patient rooms were open, the fire spread quickly into all the rooms of the newer section and into Rooms 3 and 9 of the older. The newer section and part of the corridor and Rooms 3 and 9 in the older section received extensive fire damage. The other three patient rooms, and the nurses' station, and about half of the corridor of the older addition received heavy smoke and heat damage but very little direct fire damage.

There are a number of lessons, not new, that are again emphasized in this fire tragedy. Hazardous areas should be remote from patient sleeping areas and they should be properly cut off. In this case the utility room was not cut off from the remainder of the building; in fact, it did not even have a door that could be closed to slow down fire spread into the patient area.

The combustible interior finish allowed the fire to spread rapidly throughout the newer addition of the building, developing heat and smoke that killed all 15 patients. The use of these materials must be restricted if similar loss of life is to be prevented.

This fire emphatically points out that patients cannot be expected to respond in a normal manner in a fire situation. These patients had been given tranquilizers and sleeping pills approximately an hour before the fire; they were too drugged to respond to the nurse's attempt to awaken them. Because patients in nursing homes may be drugged, and because they may be otherwise physically or mentally handicapped, fires must be controlled in the incipient stage, and they must be controlled automatically. The best method of doing this is through use of automatic sprinklers. A single person on duty in such a facility is not capable of taking decisive action toward evacuation or of assisting patients during an emergency and cannot be expected to perform any duty besides notifying the fire department or, possibly, isolating the fire by immediately closing doors, to safeguard patients' lives.

At the time this fire occurred, the State of Pennsylvania was in the process of adopting more stringent regulations governing fire safety in nursing homes. The required public hearings had been conducted and on November 6, 1971 the new regulations went into effect. These regulations will require automatic sprinkler protection in all wood frame and ordinary construction buildings and in two story buildings of noncombustible or heavy timber construction. In addition heat and smoke detection will be required in all buildings. These new regulations also place requirements on interior finish and separation of hazardous areas from patient areas. Existing nonconforming buildings have a time schedule ranging over a three year period during which they will be required to comply with these regulations to bring their buildings into conformance.

Appendix 4

HONESDALE, PA., NURSING HOME DISASTER: SPEECH BY CONGRESSMAN DAVID PRYOR TO HOUSE OF REPRESENTATIVES

FOUR FEET FROM THE DOOR

Mr. Speaker, yesterday morning I read with great sorrow and dismay the tragic account of 15 elderly people who lost their lives in another nursing home fire. The setting for this particular catastrophe was Honesdale, Pennsylvania. It was yet another in a continuing series of horror stories which are becoming often time synonymous with The American Nursing Home.

I went to Honesdale yesterday in an attempt to ask WHY—and with the hope that the story of Honesdale will not be repeated.

I found there a good town, good people—all who were shocked and asking, "How could it happen here?"

Upon interviewing the manager of the home, I found a cooperative and direct individual who struggled to explain away a holocaust.

Yes, there were a lot of reasons given—but none can justify the cold fact that 15 helpless old people, the youngest being 73, met death in an unforgivable way in a night of terror.

Mr. Speaker, subsequent to a tragedy such as Honesdale, it seems only too natural for everyone to look around to seek someone to blame. From all indications, there will be the usual investigations, reports, accusations and hearing until finally no one will listen any longer. The dead will be buried and the horrors of an October night in Honesdale will be blurred.

It doesn't take long. Who, for example, remembers or talks any longer of Marietta, where 32 elderly patients died in a similar fire? That was less than two years ago.

Or Baltimore, where food poisoning meant death last year for 28 senior citizens in a nursing home, or even the September fire in a Salt Lake City nursing home, where 6 met death?

It is too late to place blame on anyone else than ourselves, and on a system which perpetrates confusion and gross inefficiency which ultimately results in chaos. Such is the situation which shrouds the events of Honesdale and makes this case a typical example of elderly care in thousands of America's nursing homes.

"It was such a nice place," said one of the stunned local citizens, as we shuffled through the charred ruins.

"They seemed to enjoy living here," proclaimed another.

But what about a closer examination of the Honesdale fire?

What standards did this home meet? Was it safe? Was the tragedy avoidable? How many more Honesdales will there be? What are we going to do about it?

1. Only one person, a licensed, practical nurse, was on duty at the Geiger Nursing Home. When unable to make contact with the local fire station, she ran for help, thus leaving the entire home's population of elderly and feeble patients alone. There are no Federal regulations to require this home to have any additional help on duty, Mr. Speaker.

2. The rooms were not equipped with any call system to the nurse's station. It is uncontroverted now that the fire began in or near the gas dryer which was in close proximity to the patients' rooms.

Was it possible that the patients themselves knew first of the fire, and unable to make their voices heard, could have signaled the nurse on duty and provided adequate warning? Possibly, but *only* with adequate communication systems to the nurses' station. For Honesdale, no Federal regulation required call systems.

I did see lying on the floor of a patient's room—a tiny dinner bell, charred and almost melted—the manager explaining that "It was all they could afford."

3. At least one of the victims was found tied to her bed.

"She had a broken hip," was the only explanation.

Does not such a physical condition require truly skilled care? No sir, not at Honesdale—the Federal regulations are silent as applied to the quality or degree of care to be given in this type of home.

4. Had this particular nursing home been recently inspected for potential fire hazards? Yes, in fact as recently as October 2, 1971.

The question, however, is *who* performed this inspection?

What were the qualifications of that inspector? Was he trained sufficiently to recognize those possible dangerous areas which are potential hazards in a nursing home? Did he meet the very high standards necessary to perform his duty?

It is my understanding that one of the members of the local volunteer fire department had performed a recent fire inspection, and the degree of his training or individual skill at this time remains unknown.

Mr. Speaker, the facts of this tragedy speak eloquently for themselves.

Basically, the Geiger Home was a one-story, 18 bed nursing unit wing of the building of unprotected wood frame construction built in 1959 and attached to an existing 2 story wood frame farm dwelling.

There were no fire doors or fire walls separating hazardous areas such as the laundry room from patient areas.

All patient rooms opened off a central corridor. Interior finishes comprise ½ inch gypsum wallboard and cane fibered accoustical tile ceilings along the main corridors.

The wall surfaces were either ½ inch gypsum wall board or plywood paneling.

Floor finishes were either asphalt tile or sheet vinyl.

Each patient room had a standard hollow core wood door, highly combustible.

There was no automatic sprinkler system and fire detection systems were non-existent.

No smoke doors were provided throughout the building.

There was no evidence of exit signs indicating the route to exit doors.

There was no fire alarm system in the building.

The behavior of the materials and finishes indicates that the fire traveled the entire length of the nursing unit producing considerable heat, dense smoke and carbonized particles.

The entire corridor system, floor to ceiling, including patient rooms, were either completely burned out or damaged by extremely heavy smoke and carbonized deposits.

Investigation of the cause of the fire, which originated in a laundry room adjacent to the nursing unit has narrowed down the probability to a malfunction in the natural gas clothes dryer.

The interiors of all rooms in the 1959 addition were affected. Many doors to patient rooms were completely burned out offering almost no fire protection to the occupants.

An inspection of the building identified many violations of the basic principles of fire safety essential to providing a reasonably fire safe nursing home, to-wit:

(1) The building was an unprotected wood frame structure.

(2) The building was not subdivided into two or more fire sections by smoke-stop partitions.

(3) Corridor partitions provide less than one hour fire resistance.

(4) Extensive use of interior finish materials such as plywood paneling and combustible accoustical tile produced hazardous conditions.

(5) The structural system utilized, required automatic sprinkler protection throughout the building, but none existed.

(6) The building lacked a fire alarm system.

(7) Hazardous areas such as the laundry were not segregated from the nursing unit.

(8) The nursing home lacked sufficient personnel to alert the patients, alert the fire department, attempt to extinguish the fire, and evacuate the patients.

The Pennsylvania fire safety standards are extremely weak in many fire protection features when compared with Federal standards such as those promulgated under the Medicaid program. These Federal standards require that after January 1, 1970, any skilled nursing home utilized as a provider of medical assistance must comply with the 21st edition of the Life Safety Code. The following comments illustrate some of the differences between the Life Safety Code and the Pennsylvania standards:

(1) The Pennsylvania standards permit combustible construction types in a multi-story nursing home. The Life Safety Code requires that all institutional buildings two or more stories shall be constructed of at least two-hour fire resistive construction, precluding the use of combustible construction in the structural assembly.

(2) The Life Safety Code requires a fire alarm system be provided in all institutional buildings. The Pennsylvania standards require a fire alarm system only in certain multi-story buildings based on patient occupancy.

(3) The Life Safety Code requires automatic sprinkler protection throughout all institutional buildings of combustible construction, including unprotected noncombustible construction. The Pennsylvania regulations require sprinkler protection only in certain hazardous areas such as storage room, workshop or basement areas.

(4) The Life Safety Code requires that each floor used for institutional sleeping rooms, unless provided with a horizontal exit, shall be divided into at least two fire sections by a smokestop partition. No more than 150 feet of corridor length without smokestop partitions or horizontal exits is permitted. The Pennsylvania standards do not contain specific compartmentation requirements for nursing homes.

(5) The Life Safety Code requires that smoke doors in smokestop partitions may be held open only by an electric hold-open device and shall close by activation of the sprinkler system; or by a complete smoke detection system; or by a local smoke detection device located adjacent to each side of the door opening. The Pennsylvania regulations are silent on smoke door requirements for nursing homes.

Mr. Richard Amerikian, a nationally known expert and Fire Safety Consultant for the United States Public Health Service was also at the scene yesterday. He said:

"There is no possible way this structure could be justified for use as a nursing home. It does not incorporate one single protection feature. The building is a fire trap."

Mr. Speaker, Mr. Richard Stevens of the National Fire Protection Association has called nursing homes the most hazardous of all types of occupancies. Again and again we have the truth of this statement brought home to us by terrible tragedies, yet we are not moved to action. We, at all levels of Government, fail to do the things we know how to do—and out of humanity and simple public responsibility should do—for the safety of the most vulnerable and most helpless of our citizens.

A year and a half ago, in March of 1970, I addressed the House of Representatives on the lessons we should have learned from the tragic fire in the Harmar House Nursing Home in Marietta, Ohio. My colleagues will recall that this was a Medicare extended care facility in which 32 aged patients lost their lives. I pointed out that Medicare fire safety standards were inadequate and that enforcement was lax and often relied on local nursing home inspectors who are not qualified in fire safety.

Mr. Speaker, the Harmer House fire showed clearly the inadequacy of the Medicare fire safety standards and showed clearly what actions the Department of Health, Education and Welfare should take to strengthen them. In late February, about six weeks after the fire, the Social Security Administration sent a letter to State agencies advising them that at some unspecified future date new regulations would be issued incorporating in Medicare the standards for flammability of floor covering which had been in Hill-Burton standards for years. In the meantime, State agencies were asked to write to nursing homes and find out how many had unsafe carpeting.

Mr. Speaker, in my speech in March, 1970, I said of this timid and temporizing action:

"This process will take even more months."

"Why wait? Why temporize with this issue of fire safety? . . . If the Bureau of Health Insurance cannot act now when the terrible deaths of 32 helpless people are fresh in our minds, when will it act?"

Mr. Speaker, when I spoke those words I was impatient with bureaucratic delay. Today I am appalled as I report to you the incredible fact that a year and a half later no new fire safety regulations have been issued by the Department of Health, Education and Welfare. It is true that a notice of proposed rule making was published for comment in September, 1970, but this, of course, had no force.

The Medicare fire safety standards in force today are the same inadequate standards issued in 1966; the same standards which allowed highly flammable carpet on the floor at Harmer House; the same standards which allowed the 244 foot uninterrupted corridor through which the smoke and flame spread to claim 32 lives.

Mr. Speaker, the Geiger Nursing Home, which I visited yesterday, was not a Medicare home. It was not, technically, a Medicaid home, although most of the patients were welfare recipients and federally assisted patients. But the tragedy of this home again holds up the mirror so that we can see our failures.

The Pennsylvania code is less strict in many ways than the National Fire Protection Association's Life Safety Code which is required by law in the Medicaid program, yet only by virtue of the "Grandfather Clause" in the code could it pass under State law. I am not yet prepared to say whether there was some Federal responsibility for the fire and safety conditions in this home. We do know that Federal funds were being used through the Old Age Assistance Program to pay for the care of some of the patients who died there and to pay for welfare patients in similar homes throughout the country. I am looking into this aspect of the matter and will have more to report on it within a few days.

Today I ask, how many more? How many more times will we stand in the charred and acrid ruins of nursing homes making our investigations, followed by our reports and speeches, before we act?

How many more of our elders will end their lives in terror before the institutions of government begin to do, forthrightly and effectively, the things we know how to do to afford them safety?

Mr. Speaker, there is another element in this tragic episode, another piece of human tragedy which rears its ugly head every time we hear of another calamity in American nursing homes.

It is perhaps the ultimate irony in a society which we so easily call "civilized" and "democratized." It is the devastating truth that our nursing homes and our elderly themselves have become capitalized and commercialized to such an extent that they are viewed as potential dollars rather than human beings.

Mr. Speaker, in the last year and one-half I have come to the Floor of Congress and pleaded not only for institutional changes within these halls, but I have come also to speak of changes which should be made on State and Federal levels. Inevitably, in each instance, those calls for action were answered not by legislative response nor by administrative response, nor even, in fact, by judicial response. They were answered by a press release emanating from the industry spokesmen, the American Nursing Home Association and whichever state nursing home association was involved in the tragedy so described.

Mr. Speaker, yesterday afternoon I went to Honesdale, Pennsylvania, at my own expense, and carried with me experts in the field of nursing home regulations in general and fire safety in particular.

Upon my arrival at the scene of the loss of 15 lives, of two pairs of husband and wife, of people whose birth reached as far back as 1879, I was greeted by a former public relations man who now serves as Executive Director of the Pennsylvania Association of Nursing and Convalescence Homes.

Only one month ago in a hearing in Harrisburg, Pennsylvania, *his association* had opposed the implementation of fire safety regulations which would meet, MEET existing Federal standards. In words that should shock any American who feels that individual life is infinitely more valuable than property, the industry staked out its position on fire safety.

It is almost chilling to recall words recited only a month before yesterday's tragedy and to note how terribly wrong, how inconceivably misconceived the arguments of the profit-oriented industry spokesmen were in opposing those regulations.

In opposition to a proposed new regulation requiring water sprinkler systems in buildings such as those of wood frame construction the industry spokesman said, "The best safeguard is a nurse on duty."

Mr. Speaker, on the night of October 19, 1971, there was a nurse on duty and 15 lives were lost.

There was no sprinkler system.

In opposition to regulations which would apply minimal Federal standards to all nursing homes in the Commonwealth of Pennsylvania. the industry said that there should be more State emphasis on "bootleg" facilities which "in no way provide adequate" safety facilities for patients.

Mr. Speaker, on the night of October 19, the Geiger nursing home was a member of the Pennsylvania Association of Nursing and Convalescence Homes which in no way provided adequate safety facilities for patients, and 15 lives were lost.

In opposition to regulations which would have prohibited the Geiger Nursing Home from continuing its operation, the industry said that those regulations would cost the members of his organization in excess of $21 million a year.

Mr. Speaker, on the night of October 19, 15 people were lost and there is no way to compute *that* cost.

Forgive me if I am morally indignant.

Forgive me if after two years of listening to the industry's catcalls and the industry's barbs and the industry's phrases and their excuses and their calls for delay—forgive me if I now ask the industry how many more lives, how many more lives?

Mr. Speaker, I could not help but notice the sudden presence and "concern" of officials of the nursing home industry as they suddenly appeared on the scene of the previous night's tragedy.

They finally came, I imagine for the first time, to inspect the charred remains of the Geiger Nursing Home, *after* the fact. It was too late. They came to inspect the facility, after the disaster, and after they had testified only one month ago against stricter fire standards for the state of Pennsylvania.

Mr. Speaker, yesterday, as I walked through what was once a nursing home, alive with the voices and the concerns, and even the sorrows of 15 older people, I was struck by the fact that so few of us here have ever visited a nursing home either before a tragedy or after. As one who has visited homes, I know of no better way to understand the daily desperation of older Americans and to see it written on the faces or, worse yet, to see nonexistent remains.

All of the Members of this House and all compassionate Americans could not be there yesterday, and I would like to report to you today by leading the Members of this House on a tour of what was, only 72 hours ago, the home of 15 older Americans.

The stench of burnt flesh and the burnt structure permeated everything surrounding the Geiger Nursing Home. But more than the mere stench of the aftermath of this deadly holocaust, the poignant human reminder stayed on long after that smell was gone.

As one walked through what was once a hall, and looked right and left, one saw charred bells, the home's excuse for a call system, laying pitifully on decimated night tables.

One saw hair brushes, melted plastic figurines, and a set of false teeth, giving reminder to the humanity that once existed only a few hours before.

Perhaps more than anything else, two things stick out in my mind this morning as I recall all of what I saw yesterday in terms of human loss.

The first was that picture indelibly printed on my mind of a bed, the charred remainder of which was fully blackened, save for the outline of a human body.

The second was a mental picture I can only create because I was not there on the night of October 19. And that was of a woman whose body was found four feet from the door of the Geiger Nursing Home, who was desperately trying to escape from the devastation surrounding her.

Mr. Speaker, each of us is one day closer to that day, and the tragedy is that we are still no closer than four feet from the door.

Mr. Speaker, I am presently working on three proposals to attack the present situation as I have described it. I will submit them for consideration within the next few days.

(1) I will propose that 200 Federal fire inspectors be immediately hired, providing a 6 week training program by the Public Health Service, and working under the direction of the Department of Health, Education and Welfare. I have been told that there are many hundreds of engineers, who are extremely qualified for these positions, now unemployed and could be utilized in this field.

(2) I will propose legislation making applicable all existing Federal fire standards to all nursing homes in America, which receive Federal aid or house patients who receive any form of Federal assistance.

(3) I will propose legislation which will require that all nursing homes and convalescent care institutions must meet Federal standards as defined by Title XIX of the Social Security Amendments, if these homes care for patients or recipients who receive any Federal assistance or monies from the Federal Government whatsoever.

There is no time to further compromise or delay or to engage in ritualistic rhetoric.

We must act now.

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