

# Residential Radon And Public Health In Springfield, Illinois: Risk Communication, Policy Gaps, And Mitigation Strategies

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## **Abstract**

*Residential radon is an established cause of lung cancer and a persistent indoor environmental health concern. This narrative policy review assessed evidence on residential radon exposure, health risk, risk communication, policy provisions, implementation gaps, and mitigation strategies relevant to Springfield, Illinois, and Sangamon County. Peer-reviewed studies, government reports, statutes, regulatory guidance, and local public health materials available through July 2026 were reviewed. Evidence was synthesized across exposure pathways, lung cancer risk, housing and social determinants, communication, testing, mitigation, surveillance, and policy implementation. Federal, Illinois, and local provisions were compared using a content-context-actors-process framework. Lung cancer was the only health outcome supported by established causal evidence, and smoking substantially increased absolute risk. Illinois had important protections, including professional licensing, real-estate and rental disclosure, child-care testing, and radon-resistant construction, but existing homes continued to rely heavily on voluntary action. Major gaps included dated and incomplete local surveillance, limited mitigation financing, uneven rental protection, and limited post-mitigation verification. Renters and low-income homeowners faced particular barriers to testing and remediation. The review supports a coordinated Springfield-Sangamon County strategy that prioritizes current surveillance, targeted testing, clear risk communication, mitigation assistance, legally feasible rental protections, licensed mitigation, and routine evaluation. Program success should be measured by completed testing, mitigation uptake, verified exposure reduction, and equitable access.*

**Keywords:** radon; lung cancer; risk communication; environmental health policy; housing equity; mitigation

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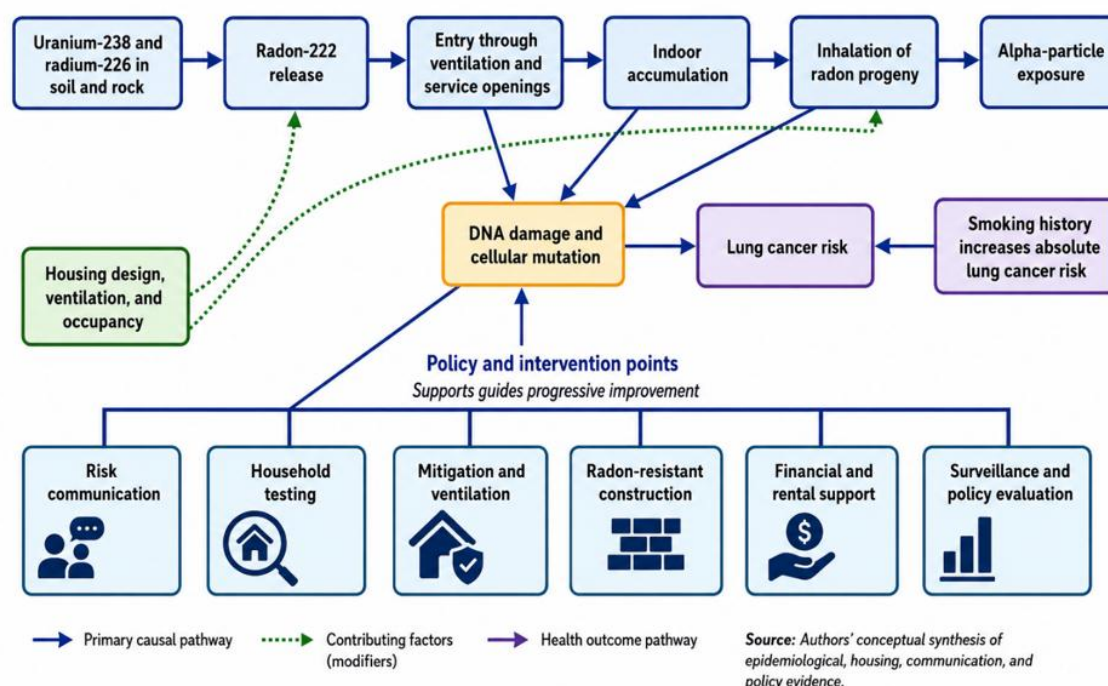
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## **I. Introduction**

Radon is a colorless, odorless, and radioactive noble gas. Radon-222 is formed within the uranium-238 decay series through the decay of radium-226 in soil, rock, and groundwater. After release from the ground, radon moves through pore spaces and enters buildings through foundation cracks, floor drains, sump pits, crawl spaces, construction joints, and openings around service pipes. Indoor concentrations rise when soil gas entry exceeds removal through air exchange. Lower floors and enclosed spaces often record higher concentrations because contact with the ground is greater and ventilation is often limited. Household testing is therefore required to determine indoor exposure. Geographic risk classification does not establish the concentration within a specific dwelling (Illinois Department of Public Health [IDPH], n.d.).

After inhalation, radon progeny deposit on airway surfaces. Alpha particles released during radioactive decay transfer energy to bronchial epithelial cells. Repeated exposure produces DNA damage, chromosomal injury, and mutations involved in lung carcinogenesis. Evidence from miner cohorts and residential studies established radon as a human lung carcinogen. The International Agency for Research on Cancer classified radon-222 and its decay products as carcinogenic to humans, Group 1 (International Agency for Research on Cancer [IARC], 2012). Residential studies also established a concentration-related association between radon exposure and lung cancer (Cheng et al., 2021). Figure 1 presents the pathway from environmental origin to residential exposure, biological injury, testing, and mitigation.



**Figure 1. Conceptual Pathway for Residential Radon Exposure and Policy Response**

The public health burden is substantial. The United States Environmental Protection Agency estimated about 21,000 radon-related lung cancer deaths each year in the United States. Radon is regarded as the second leading cause of lung cancer after tobacco smoking and the leading cause among people who never smoked (United States Environmental Protection Agency [EPA], 2026b). A systematic review and meta-analysis pooled evidence from 2,341 never smoker cases and 8,967 never smoker controls. Increased lung cancer risk was observed with rising residential radon concentrations among never smokers and ever smokers (Cheng et al., 2021).

No established exposure threshold is free from risk. The EPA recommended mitigation when indoor radon concentrations reached 4 pCi/L or higher. Mitigation was also recommended for consideration between 2 and 4 pCi/L. These thresholds guide public health action rather than define a safe exposure level (EPA, 2025). Testing therefore serves as the first step in exposure control. A low geographic risk classification should not replace household measurement.

Tobacco smoking increased the absolute risk linked with radon exposure. Both exposures damaged bronchial tissue, and their combined effect produced a larger disease burden than either exposure considered separately. Smokers living in homes with elevated radon therefore represented a high-priority group for prevention. A focus limited to smokers would still be inadequate because residential radon also contributed to lung cancer among people without a smoking history (Cheng et al., 2021). Risk communication should present both messages. Smoking cessation reduces lung cancer risk. Radon testing and mitigation reduce an independent environmental exposure.

Lung cancer is the only health outcome with established causal evidence in humans. Associations with leukemia, melanoma, chronic obstructive pulmonary disease, renal disease, and other conditions have been reported, yet findings have remained inconsistent. A 2024 systematic review included 129 studies. No statistically significant pooled association was found for most health outcomes other than lung cancer. Several estimates approached statistical significance, but the evidence did not support firm causal statements (Henyoh et al., 2024). The present review therefore treated lung cancer as the principal health outcome. Other outcomes were classified as emerging evidence and were interpreted with restraint.

Illinois has a clear basis for radon prevention. Central and northern Illinois have recorded higher soil radon potential. Elevated indoor results have also been reported across the state (IDPH, n.d.). The IDPH reported 41% of tested Illinois homes exceeded 4 pCi/L. This figure described tested homes and did not represent population prevalence. Selection into testing was influenced by property transactions, household awareness, perceived risk, income, and access to testing services. The percentage therefore should not be interpreted as the prevalence of elevated radon across all Illinois homes.

The Illinois Emergency Management Agency and Office of Homeland Security maintained an interactive radon map by county and ZIP code. The public dataset had important limits. Measurement records covered 2003 through 2019. Results were submitted by licensed measurement professionals. Only the highest submitted result for each address was retained. Measurements performed independently by homeowners were not fully represented. These features limited estimates of exposure prevalence, testing coverage, repeat testing, and mitigation completion (Illinois Emergency Management Agency and Office of Homeland Security [IEMA-OHS], n.d.-c).

Springfield is located in Sangamon County within central Illinois. Soil radon potential, ground-contact housing, basement occupancy, foundation openings, air pressure differences, and limited ventilation created plausible pathways for indoor accumulation. State sources confirmed radon concern across the wider region. The sources reviewed did not provide a complete Springfield estimate for household testing, elevated results, completed mitigation, or radon-attributable lung cancer. This evidence gap prevented a precise local burden estimate. The gap also limited identification of neighborhoods with low testing access or reduced capacity to pay for mitigation.

Illinois adopted several radon-control measures. Under the Illinois Radon Awareness Act, sellers must provide specified radon information and known test records during covered residential property transactions, but the Act does not impose a general duty on sellers to test or mitigate before sale. Current rental provisions also require specified disclosures to prospective and renewing tenants. Tenants receive a defined period for independent testing, but the statute does not create a general testing or mitigation duty for lessors or tenants (Illinois General Assembly, n.d.-b; Illinois Emergency Management Agency and Office of Homeland Security [IEMA-OHS], n.d.-a).

Licensed child-care facilities are required to undergo radon testing at least once every three years. The cited statute establishes periodic testing and disclosure but does not impose a general statewide duty to remediate every elevated result. Illinois policy therefore provides different levels of protection across residential sales, rental housing, and child-care settings: disclosure and periodic testing increase access to information, but neither measure by itself guarantees exposure reduction (Illinois General Assembly, n.d.-a).

Voluntary testing and disclosure have not ensured equal protection. Radon is invisible and produces no immediate warning signs. Protective action depends on awareness, perceived risk, access to test devices, control over housing decisions, ability to pay, availability of licensed professionals, and confidence in the mitigation process. A systematic review identified persistent gaps between radon awareness, risk perception, testing, and remediation (Cori et al., 2022). Information alone was therefore insufficient when residents lacked resources or authority to act.

Cost, fragmented service pathways, weak legal duties, limited financial assistance, and poor coordination among residents, authorities, and contractors were also identified as barriers to domestic mitigation (Hevey et al., 2023). Renters faced additional constraints because testing decisions, building alterations, and mitigation expenses often rested with property owners. Low-income homeowners also faced greater difficulty paying for professional measurement and remediation. These barriers framed radon exposure as an environmental health equity concern rather than a matter of individual awareness alone.

United States evidence also showed geographic and socioeconomic differences in testing activity. A North Carolina study found low testing rates across many census tracts and identified relationships between neighborhood conditions and testing activity (Yang et al., 2024). Unequal testing created unequal detection. Communities with low testing rates risked appearing to have low exposure because fewer measurements were available. A policy response based mainly on voluntary household action therefore risked lower protection among renters and households with fewer financial resources.

Effective radon control requires linked action across risk communication, testing access, housing regulation, mitigation finance, professional standards, surveillance, and program evaluation. The National Radon Action Plan placed emphasis on identifying buildings with elevated radon, reducing existing exposure, preventing exposure in new buildings, and directing resources toward underserved populations (National Radon Action Plan Leadership Council, 2021). Policy evaluation also requires measurable objectives, defined responsibilities, implementation indicators, surveillance data, and routine review (Martell et al., 2023). These elements provide a basis for assessing current arrangements in Springfield.

This narrative policy review examined evidence on residential radon exposure, associated health risks, risk communication, policy provisions, implementation gaps, and mitigation strategies relevant to Springfield, Illinois. The review assessed alignment between scientific evidence and current policy. Attention was given to equity, rental housing, testing access, mitigation affordability, data quality, and local accountability. The intended outcome was a practical policy framework for reducing preventable radon exposure and radon-related lung cancer.

## **II. Methods**

### **Review design**

A narrative policy review was conducted to examine residential radon exposure, health risks, risk communication, policy provisions, implementation gaps, and mitigation strategies relevant to Springfield, Illinois. A narrative approach was selected because the review combined epidemiological studies, risk communication research, legislation, regulatory guidance, surveillance information, and program reports. These sources differed in design, purpose, population, and outcome measurement.

The review process was guided by the Scale for the Assessment of Narrative Review Articles. This framework addresses the justification of the review, statement of aims, description of the literature search, referencing, scientific reasoning, and presentation of relevant evidence (Baethge et al., 2019). The review was not designed as a systematic review or meta-analysis. Its purpose was to produce an evidence-informed assessment of public health policy and implementation.

### **Review questions**

Five questions guided the review. The first question examined the established and emerging health effects associated with residential radon exposure. The second examined housing, environmental, and social factors linked with exposure, testing, and mitigation. The third examined how radon risk was communicated to residents. The fourth examined federal, Illinois, Sangamon County, and Springfield policy provisions. The fifth examined policy and implementation gaps affecting prevention, testing, mitigation, surveillance, and equity.

### **Information sources and search strategy**

Peer-reviewed literature published from January 2000 through July 27, 2026, was searched in PubMed and Google Scholar. Older landmark reports and studies were retained when they established radon carcinogenicity, exposure pathways, dose-response relationships, or major policy principles.

Search terms included residential radon, indoor radon, radon exposure, radon lung cancer, radon smoking, radon risk communication, radon awareness, radon testing, radon mitigation, radon policy, environmental justice and radon, rental housing and radon, Illinois radon, Sangamon County radon, and Springfield Illinois radon. Terms were combined with lung cancer, housing, tenants, landlords, building codes, social determinants, policy implementation, surveillance, cost, and health equity.

Reference lists from relevant systematic reviews, policy analyses, and government reports were examined to locate additional sources. Priority was assigned to systematic reviews, meta-analyses, large observational studies, recent qualitative studies, and policy evaluations published from 2021 through July 2026.

Government and legal sources were searched separately. Sources included the United States Environmental Protection Agency, the United States Department of Housing and Urban Development, the Illinois General Assembly, the Illinois Department of Public Health, the Illinois Emergency Management Agency and Office of Homeland Security, Sangamon County agencies, and the City of Springfield. Current Illinois statutes and administrative provisions were checked against state sources on July 27, 2026. The federal search included the National Radon Action Plan and current EPA standards of practice. Illinois sources included the Illinois Radon Awareness Act, the Radon Resistant Construction Act, licensing requirements, child-care testing provisions, public guidance, and radon reporting systems.

### **Eligibility criteria**

Sources were included when they addressed residential radon exposure, lung cancer, risk perception, public communication, household testing, mitigation, housing conditions, social inequalities, legislation, regulation, program implementation, or policy evaluation. Studies conducted in the United States received priority. International evidence was included where United States or Illinois evidence was limited.

Occupational studies were retained only where they supported established biological or epidemiological evidence. Studies focused solely on occupational exposure were not used to define residential policy needs. Evidence on outcomes other than lung cancer was included only to assess the strength and consistency of reported associations.

Policy documents were included when they specified a legal duty, recommended action, responsible institution, target population, testing standard, mitigation requirement, disclosure provision, funding arrangement, reporting mechanism, or evaluation process. Public information pages were included when they represented current official risk communication.

Duplicate publications, commercial webpages, unsupported opinion pieces, and sources without clear public health or policy relevance were excluded. News reports were not treated as primary evidence. They were considered only when they directed the review toward an official statement or public record.

### **Evidence extraction**

Information was entered into a structured extraction matrix. The fields covered author or issuing body, publication year, jurisdiction, study design, population, exposure measure, health outcome, communication issue, policy level, target group, responsible agency, legal duty, enforcement provision, funding arrangement, equity implication, reported barrier, and proposed intervention.

For empirical studies, attention was given to sample size, exposure assessment, outcome definition, adjustment for smoking, housing characteristics, selection bias, and relevance to Springfield. For reviews, attention was given to search scope, study inclusion, consistency of results, and stated limitations. Greater interpretive weight was assigned to systematic reviews, meta-analyses, national scientific reports, official statutes, and current regulatory standards.

### **Policy analysis framework**

Policy analysis was informed by the health policy triangle. This framework examines policy content, context, actors, and process (Walt & Gilson, 1994). Content referred to legal requirements, guidance, thresholds, testing provisions, mitigation duties, and construction standards. Context referred to the radon burden, housing conditions, local governance, financial constraints, and public awareness. Actors included federal and state agencies, local government, property owners, landlords, tenants, builders, licensed professionals, health workers, and residents. Process referred to policy development, communication, implementation, enforcement, monitoring, and review.

Each policy was assessed across nine domains. These domains were population coverage, legal responsibility, testing requirements, mitigation requirements, enforcement, financial support, risk communication, surveillance, and evaluation. Radon action plan indicators proposed by Martell et al. (2023) informed the assessment of policy objectives, implementation measures, responsible institutions, monitoring systems, and review procedures. The National Radon Action Plan provided the federal benchmark for identifying elevated exposure, reducing radon in existing buildings, preventing exposure in new buildings, and improving protection for underserved populations (National Radon Action Plan Leadership Council, 2021).

### **Narrative synthesis**

Findings were organized into seven themes. These were exposure pathways, health effects, housing and social determinants, risk perception, risk communication, policy coverage, and mitigation. Evidence from scientific studies was compared with current policy provisions. Areas of alignment, inconsistency, and limited implementation were identified.

Policy gaps were recorded where scientific evidence supported action but policy lacked a defined duty, funding source, enforcement process, surveillance system, or evaluation measure. Equity gaps were recorded where residents faced unequal access to testing, mitigation, housing control, or public information.

No pooled effect estimate was calculated because the review included heterogeneous evidence and policy documents. Differences between sources were retained and examined rather than combined into one estimate. Local claims were restricted to evidence specific to Illinois, Sangamon County, or Springfield. Findings from other jurisdictions were presented as supporting evidence rather than direct estimates of local conditions.

### **Ethical considerations**

The review used published literature, legislation, public records, and government documents. No human participants or identifiable private data were included. Institutional ethics approval was therefore not required.

## **III. Findings**

### **Radon Sources and Residential Exposure Pathways**

The reviewed evidence identified soil gas as the principal source of residential radon. Radon enters buildings through foundation cracks, construction joints, sump pits, crawl spaces, floor drains, and openings around service lines. Indoor concentrations can vary between nearby homes because geology interacts with foundation design, air pressure, ventilation, occupancy, weather, and measurement duration. Groundwater can be an additional source in selected settings, although inhalation of contaminated indoor air remains the principal residential exposure route. Federal and Illinois guidance therefore supports testing every home rather than inferring household exposure from county or zone classification (Illinois Emergency Management Agency and Office of Homeland Security [IEMA-OHS], n.d.-c; United States Environmental Protection Agency [EPA], 2026b).

Radon decay produced short-lived progeny, which attached to airborne particles and deposited in the respiratory tract after inhalation. Alpha radiation then injured bronchial epithelial cells. Repeated exposure increased the probability of DNA damage and malignant transformation. Exposure was shaped by

concentration, duration, time spent indoors, and smoking history. Testing identified indoor concentration, while mitigation reduced soil gas entry and indoor accumulation.

### **Health Effects of Radon Exposure**

Lung cancer was the only health outcome supported by established causal evidence. A systematic review and meta-analysis found increased lung cancer risk from residential radon among people who never smoked and among people with a smoking history (Cheng et al., 2021). EPA risk estimates also showed a much greater absolute risk among smokers at the same radon concentration. The evidence supported a joint prevention approach based on radon reduction and smoking cessation (EPA, 2026b).

Evidence for leukemia, skin cancer, chronic obstructive pulmonary disease, renal disease, and other outcomes was inconsistent. A 2024 systematic review and meta-analysis identified lung cancer as the only well established human health effect. Pooled estimates for most other outcomes did not support firm causal claims (Henyoh et al., 2024). The review therefore treated these outcomes as emerging evidence. Claims of causation were not retained.

### **Housing and Environmental Determinants**

Building conditions affected radon entry and accumulation. Ground-contact, basement and crawl space design, unsealed openings, foundation defects, and low air exchange increased exposure potential. Energy efficiency measures also required attention because reduced uncontrolled air exchange altered indoor pressure and ventilation. Radon-resistant construction reduced entry pathways in new homes, yet post-construction testing remained necessary because passive components did not confirm an acceptable indoor concentration (EPA, 2026a).

The EPA radon-zone map and the Illinois interactive map support geographic planning, but neither source replaces household testing. The Illinois map states that elevated results have occurred across the state. Its public dataset includes professional measurements from 2003 through 2019, retains only the highest submitted result for each address, and does not fully represent homeowner measurements. Public mitigation data cover 2005 through 2011. These limitations reduce the map's value for current prevalence estimates, trend analysis, and evaluation of completed remediation (IEMA-OHS, n.d.-c).

### **Social Determinants of Testing and Mitigation**

Testing and mitigation were influenced by income, education, housing tenure, rurality, access to information, and service availability. A Kentucky analysis linked home testing activity with county social and environmental conditions, which showed exposure detection was partly shaped by community resources (Stanifer et al., 2022). A North Carolina study reported fewer than 10 tests per 1,000 residents in 67% of census tracts. Testing levels also differed across neighborhood socioeconomic conditions (Yang et al., 2024).

Unequal testing produced unequal detection. Areas with fewer tests risked appearing less affected because fewer results entered surveillance systems. Renters faced added barriers because property owners controlled structural work. Low-income homeowners faced direct costs for professional confirmation and mitigation. Recent qualitative evidence also identified cost concerns, distrust, low perceived personal risk, concern about property value, and limited regulation as barriers to home testing (Iuliano et al., 2026). These findings supported treatment of radon as a housing equity issue.

### **Risk Perception and Public Awareness**

Public knowledge did not consistently lead to testing or mitigation. The systematic review by Cori et al. (2022) found incomplete awareness, low perceived susceptibility, uncertainty about action levels, and weak movement from knowledge to protective behavior. Radon lacked sensory warning signs and caused no immediate symptoms. These features reduced urgency and encouraged optimistic bias.

Message framing affected perceived risk and action intentions. Risk perception increased when radon was framed as indoor air pollution, while testing and mitigation intentions also depended on perceived burden and stigma (Perko & Hevey, 2024). Effective communication therefore required a clear health statement, a numeric action threshold, simple testing steps, interpretation guidance, contractor referral, cost information, and follow up after an elevated result. Awareness messages without service access or financial support were insufficient.

### **Risk Communication in Springfield and Sangamon County**

Illinois communication resources include public guidance, a low-cost test-kit pathway, a licensed-professional directory, tenant guidance, real-estate forms, and a state information line. These resources provide core information on testing and mitigation. Springfield Public Works materials also reference radon-resistant construction for covered new residential projects, reflecting the statewide construction requirement (City of Springfield, 2019; IEMA-OHS, n.d.-a, n.d.-b).

The review did not identify a single Springfield or Sangamon County platform reporting current testing coverage, elevated results, repeat testing, mitigation completion, neighborhood variation, financial assistance, and program outcomes. This limits local risk interpretation and policy evaluation. State map data are dated and selected through professional testing, while local household-level denominators were not identified (IEMA-OHS, n.d.-c).

A community program led by the University of Illinois Springfield expanded local education and free testing during 2026. IEMA supplied about 300 short-term test kits, and more than 80 kits had been distributed by March 2026. The program also linked radon education with lung cancer screening support and rural outreach. Formal outcome findings on test completion, elevated results, mitigation uptake, and population reach were not yet published (University of Illinois Springfield, 2026). The program represented a useful local delivery model, but stronger surveillance and public reporting were still required.

### **Federal Radon Policy**

Federal policy relies on risk guidance, technical standards, grants, housing requirements, and multisector action. EPA recommends fixing homes at 4 pCi/L or higher and considering exposure reduction between 2 and 4 pCi/L; EPA also states that no known safe radon level exists (EPA, 2025). Current standards address measurement in homes and shared buildings, soil-gas mitigation, quality assurance, and radon control in new construction (EPA, 2026c).

The National Radon Action Plan 2021 to 2025 focused on finding, fixing, and preventing high radon levels, with attention to underserved communities. HUD policy also required radon consideration within covered environmental reviews from April 11, 2024. Federal policy therefore linked radon with housing finance, community development, and public housing rather than treating exposure solely as a private household concern (National Radon Action Plan Leadership Council, 2021, United States Department of Housing and Urban Development [HUD], 2024).

Federal provisions did not create a universal residential testing or mitigation duty. Implementation depended on state law, local adoption, program funding, housing transactions, and household action. This structure left uneven protection across housing types and jurisdictions.

### **Illinois Radon Policy**

Illinois has a comparatively developed radon-policy framework. The Radon Industry Licensing Act authorizes regulation of measurement and mitigation professionals. The Radon Resistant Construction Act requires passive radon-resistant construction in 'new residential construction' as defined by the Act, including single-family homes, townhouses, condominiums, and dwellings containing two or fewer apartments. Illinois rules also set construction and professional-practice requirements (Illinois General Assembly, n.d.-c, n.d.-d).

The Illinois Radon Awareness Act requires approved information and known radon records during covered residential sales. Rental provisions require lessors to provide a tenant guide, known hazardous results, and a disclosure form for covered units below the third story. A tenant receives 90 days from the start of the lease to complete independent testing; under specified conditions, an elevated result can permit lease termination if the lessor does not mitigate. The statute does not impose a general duty on either party to test or mitigate. It also limits home-rule regulation of lease agreements or tenant rights when local rules would be inconsistent with the Act, an important constraint for local policy design (Illinois General Assembly, n.d.-b; IEMA-OHS, n.d.-a).

Licensed child-care facilities are required to test for radon at least once every three years. The requirement establishes periodic measurement and posting of the current measurement report, but the cited statute does not impose a general statewide remediation duty after every elevated result (Illinois General Assembly, n.d.-a). Policy strength therefore varies by setting: new construction receives preventive requirements, real-estate sales receive disclosure, rental housing receives information and limited tenant remedies, and child-care facilities receive periodic testing.

**Table 1: Comparison of Federal, Illinois, and Local Radon Policy Coverage**

| <b>Policy level and instrument</b>             | <b>Main provision</b>                                                                                                                                                                      | <b>Population or setting covered</b>             | <b>Main implementation gap</b>                                                        |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------|
| Federal. EPA guidance and ANSI/AARST standards | EPA recommends fixing homes at 4 pCi/L or higher and considering exposure reduction between 2 and 4 pCi/L. Standards address testing, mitigation, quality assurance, and new construction. | Homes and other residential or shared buildings. | No universal federal duty for residential testing, remediation, or financial support. |



| <b>Policy level and instrument</b>                                          | <b>Main provision</b>                                                                                                                                                                                         | <b>Population or setting covered</b>                                                | <b>Main implementation gap</b>                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Federal housing. HUD Notice CPD-23-103                                      | Radon must be considered in contamination analyses for covered HUD environmental reviews. Testing and mitigation are eligible expenses under selected HUD programs.                                           | HUD-funded projects subject to 24 CFR Parts 50 or 58.                               | The notice does not impose a general testing duty. Coverage depends on program rules, project type, and available funding.                                                                                                                                    |
| Illinois. Radon Industry Licensing Act and Radon Resistant Construction Act | Professional radon measurement and mitigation require state licensing. Covered new residential construction must include passive radon-resistant features.                                                    | Radon service providers and new residential construction as defined by 420 ILCS 52. | Existing homes remain outside the construction duty. Post-construction testing is still needed to confirm indoor concentrations.                                                                                                                              |
| Illinois. Radon Awareness Act                                               | Sellers must provide approved radon information and known records. Lessors of covered units must provide tenant guidance and known hazardous results; tenants receive 90 days to conduct independent testing. | Residential sales and rental units below the third story.                           | The law does not impose a general seller or lessor duty to test or mitigate. Local regulation of lease agreements and tenant rights must also remain consistent with the Act's home-rule limitation.                                                          |
| Illinois. Child Care Act, 225 ILCS 10/5.8                                   | Licensed facilities must test for radon at least once every 3 years and post the current measurement report.                                                                                                  | Licensed day care centers, day care homes, and group day care homes.                | The cited statute requires testing and disclosure but does not state a general remediation duty after every elevated result.                                                                                                                                  |
| Springfield and Sangamon County. Local implementation                       | Springfield public works materials reference radon-resistant construction. State and community partners provide education, testing resources, and professional directories.                                   | New residential construction and voluntary community outreach.                      | No Springfield-specific universal testing or mitigation requirement, current local surveillance dashboard, or standing local mitigation subsidy was identified in the reviewed public sources; local rental policy options are also constrained by state law. |

*Note. Current as of July 27, 2026. Sources included the U.S. Environmental Protection Agency, U.S. Department of Housing and Urban Development, Illinois General Assembly, Illinois Emergency Management Agency and Office of Homeland Security, and City of Springfield Public Works. The local gap statement reflects the public sources reviewed and does not exclude unpublished local practice.*

### **Local Policy and Implementation Gaps**

The principal gap concerned the distance between disclosure and exposure reduction. Information duties increased transparency, but an elevated result did not always trigger funded mitigation, enforcement, or verification. Rental provisions placed initial testing responsibility on tenants and allowed exit from a lease. This remedy did not ensure correction of the building for current or future occupants.

A second gap concerned surveillance. Illinois maintained professional licensing and historical measurement data, but the public map lacked recent measurement and mitigation periods. Springfield-specific reporting on tests, elevated results, post-mitigation confirmation, rental properties, schools, and child care facilities was not identified. A third gap concerned finance. The State Indoor Radon Grant supported state activity, yet the reviewed local sources did not identify a standing mitigation subsidy for low-income Springfield households. A fourth gap concerned evaluation. Clear local indicators for awareness, kit distribution, test completion, mitigation, contractor access, and equity were absent.

### **Mitigation Strategies**

Testing remains the entry point for prevention. Short-term tests support initial screening, whereas long-term tests can provide a stronger estimate of average exposure when time and occupancy allow. EPA recommends fixing homes at or above 4 pCi/L and considering exposure reduction between 2 and 4 pCi/L. Current professional standards address test placement, closed-building conditions where applicable, documentation, quality control, and post-mitigation testing (EPA, 2025, 2026c).

Active soil depressurization is the principal established mitigation method for many existing homes. Sealing can support system performance but should not be treated as a stand-alone response. New-construction standards use gas-permeable layers, barriers, sealed openings, and vent piping, with activation when testing indicates elevated levels. Illinois requires passive radon-resistant construction for covered new residential construction, and Springfield building materials reflect this requirement. Post-construction testing remains necessary to verify performance (City of Springfield, 2019; Illinois General Assembly, n.d. -d; EPA, 2026c).

Programs required more than technical guidance. Evidence from residents, authorities, and contractors identified legal duties, financial support, accredited professionals, clear referral pathways, and coordinated communication as major facilitators (Hevey et al., 2023). A Pennsylvania outreach program also showed free testing distribution required tracking of request, completion, result, and mitigation stages (Pillay et al., 2025). Springfield programs should therefore measure progression from awareness to verified exposure reduction.

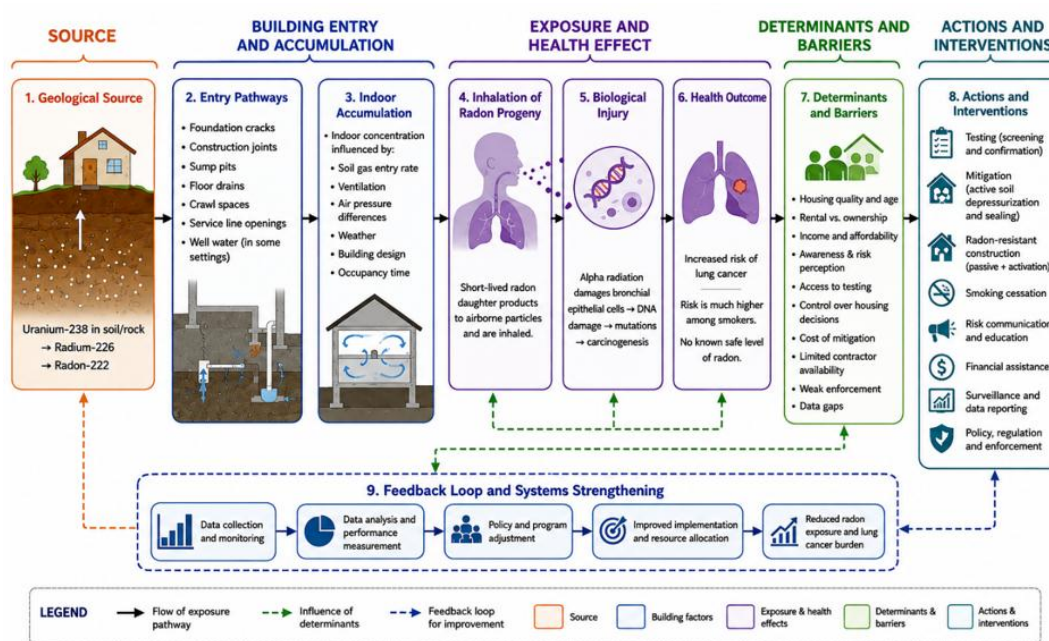


## Systems Perspective

The findings supported a linked system rather than a sequence based only on individual choice. Environmental radon entered homes through building pathways. Housing quality and ventilation shaped concentration. Smoking increased absolute lung cancer risk. Awareness influenced testing, but income, tenure, regulation, and contractor supply shaped action after testing. Weak surveillance reduced policy feedback. Incomplete mitigation preserved exposure and future disease burden.

Protective feedback arose through testing, disclosure, mitigation, radon-resistant construction, professional regulation, financial assistance, smoking cessation, and public reporting. Each intervention addressed a different point in the exposure pathway. Communication without affordable mitigation left the final control step incomplete. Construction rules without post-construction testing left performance unverified. Disclosure without remediation preserved risk for future occupants.

Figure 2 presents the proposed systems pathway, and Table 1 compares federal, Illinois, and local policy coverage. Together, the findings identify four priority areas for Springfield and Sangamon County: current local surveillance, targeted communication and testing, financial support for mitigation, and stronger protection for renters and other residents with limited control over housing conditions.



This systems pathway illustrates how radon moves from its geological source to health outcomes and how multi-level interventions and feedback strengthen protection for residents of Springfield, Illinois.

**Figure 2. Systems Pathway for Residential Radon Control in Springfield, Illinois**

## IV. Discussion

### Principal Findings

This review identified residential radon as a preventable public health exposure with an established relationship with lung cancer. The evidence supported risk among people with and without a smoking history. Smoking increased absolute lung cancer risk, which strengthened the need for combined radon reduction and tobacco control. Evidence for health outcomes other than lung cancer remained inconsistent. Such outcomes should receive limited attention in policy communication until stronger causal evidence becomes available (Cheng et al., 2021, Henyoh et al., 2024).

The review also identified a gap between risk identification and exposure reduction. Household testing detects elevated concentrations, but testing alone does not reduce exposure. Protection depends on correct result interpretation, access to licensed professionals, affordable mitigation, and post-mitigation verification. EPA recommends fixing homes at concentrations of 4 pCi/L or higher and considering exposure reduction between 2 and 4 pCi/L; no known safe exposure level has been identified (United States Environmental Protection Agency [EPA], 2025).

Illinois has an established policy structure for professional licensing, real-estate disclosure, rental disclosure, child-care testing, and radon-resistant construction. Covered new residential construction must include passive radon-resistant features, and licensed child-care facilities must be tested at least once every

three years. These provisions are meaningful prevention measures, but protection differs across settings. Existing owner-occupied homes rely mainly on voluntary action, while rental policy emphasizes disclosure and tenant-initiated testing. Disclosure does not guarantee remediation after an elevated result (Illinois General Assembly, n.d.-a, n.d.-b, n.d.-c, n.d.-d).

A local surveillance weakness was also identified. The Illinois public map uses measurement data from 2003 through 2019 and mitigation data from 2005 through 2011. The measurement dataset is based on professional reports and retains only the highest submitted result for each address. These features limit assessment of current testing coverage, repeat testing, mitigation completion, and neighborhood differences in Springfield (Illinois Emergency Management Agency and Office of Homeland Security [IEMA-OHS], n.d.-c).

### **Public Health Interpretation**

Residential radon control should not be framed as a matter of individual knowledge alone. Geological conditions influenced exposure potential, while housing quality, tenure, income, service availability, and control over structural decisions shaped household responses. Neighborhood differences in testing also showed unequal detection of exposure. Low testing activity produced limited data, which risked masking environmental burden in communities with fewer resources (Yang et al., 2024).

Renters faced a distinct disadvantage. A tenant often lacked authority to install a mitigation system. Moving after an elevated test did not remove exposure from the property. The next occupant remained at risk unless the building was repaired. A policy model based on disclosure and lease termination shifted responsibility toward residents and left the environmental source unchanged. Greater protection required clear property owner duties, defined response periods, verified mitigation, and safeguards against displacement or rent increases linked with remediation.

Low-income homeowners faced a separate barrier. Testing costs were limited relative to mitigation costs, but an elevated result created a larger financial decision. Awareness campaigns without financial support risked identifying hazards without providing a practical route to correction. Research involving residents, authorities, and contractors identified cost, fragmented services, weak legal duties, contractor access, and limited coordination as barriers to mitigation. Legal requirements, financial support, accredited professionals, and clear referral routes were identified as facilitators (Hevey et al., 2023).

Radon policy also required alignment with lung cancer prevention. Smokers and former smokers living in homes with elevated radon faced higher absolute risk. Public health programs should link radon education with smoking cessation and eligible lung cancer screening services. Radon communication should still address people who never smoked because residential exposure increased lung cancer risk in this group (Cheng et al., 2021).

### **Risk Communication Implications**

Risk communication should move residents through a complete action pathway. This pathway includes awareness, test access, correct test placement, result interpretation, professional referral, mitigation, and confirmation of reduced concentrations. Communication focused only on cancer risk was unlikely to produce sustained action where cost or housing authority prevented remediation.

Risk communication should consistently convey four points. First, radon is invisible and exposure can only be determined through testing. Second, every home should be tested regardless of geographic classification. Third, EPA recommends fixing homes at 4 pCi/L or higher. Fourth, EPA recommends considering exposure reduction between 2 and 4 pCi/L because no known safe level has been established. These messages should be consistent across local health-department materials, real-estate documents, rental guidance, clinical education, and community outreach (EPA, 2025, 2026b).

Audience-specific communication was also required. Homeowners needed testing and contractor guidance. Renters needed information on disclosure rights, documentation, landlord communication, and local assistance. Landlords needed clear expectations for testing, remediation, and post-mitigation verification. Builders needed construction standards and post-construction testing guidance. Health professionals needed brief messages linking radon with lung cancer prevention.

The University of Illinois Springfield outreach program offered a locally relevant communication platform. The program distributed free test kits through libraries, community events, and local partnerships during 2026. About 300 short-term kits were supplied, and more than 80 had been distributed by March 30, 2026. Published outcome data on completed tests, elevated results, mitigation, and population reach were not yet available (University of Illinois Springfield, 2026). Future evaluation should record each stage from kit distribution through verified mitigation.

## **Policy Implications**

Springfield and Sangamon County would benefit from a coordinated policy response rather than a stand-alone awareness campaign. The 2021-2025 National Radon Action Plan remains a useful recent federal benchmark because it integrated identification, remediation, prevention, financing, professional standards, and housing systems. The plan set a national goal of finding, fixing, or preventing high indoor radon levels in eight million buildings by 2025 and preventing 3,500 lung-cancer deaths per year (National Radon Action Plan Leadership Council, 2021).

The first policy need involved current surveillance. Springfield and Sangamon County should establish annual reporting on the number of homes tested, the proportion at or above 4 pCi/L, the proportion between 2 and 4 pCi/L, the number mitigated, and the proportion receiving post-mitigation testing. Results should be reported by ZIP code or census tract after privacy protection. Reporting should also distinguish owner-occupied housing, rental housing, schools, child care facilities, and publicly supported housing.

The second need involved financial assistance. A local mitigation support program should prioritize low-income homeowners, renters, child care settings, and housing supported by public funds. HUD policy required radon consideration for covered environmental reviews from April 11, 2024. Radon testing and mitigation were eligible expenses under selected community development programs. Springfield should examine these funding routes alongside state grants and local healthy housing resources (United States Department of Housing and Urban Development [HUD], 2024).

The third need concerns rental housing. Because the Illinois Radon Awareness Act limits home-rule regulation that is inconsistent with state rules on lease agreements and tenant rights, Springfield should assess legal authority before adopting mandatory local rental requirements. Locally permissible measures could include disclosure support, referral pathways, incentives, data collection, and conditions attached to locally controlled housing funds, while broader mandatory testing or mitigation duties may require state-level action. This approach would move policy toward exposure reduction without overstating local regulatory authority (Illinois General Assembly, n.d.-b).

The fourth need involved existing buildings. Illinois construction law addressed new residential buildings, but older homes remained dependent on testing and retrofit. Local housing rehabilitation, weatherization, energy efficiency, and building permit programs should include radon screening. Energy improvements should not proceed without attention to ventilation and soil gas entry where indoor air pressure changes were expected.

## **Proposed Policy Action Framework**

A staged framework is proposed. During the first 12 months, local agencies should establish a radon working group, update communication materials, create one public information portal, expand free test kit distribution, and define surveillance indicators. The working group should include public health officials, housing authorities, building officials, landlords, tenant representatives, licensed professionals, healthcare workers, community organizations, and academic partners.

During years 1 and 2, Springfield should develop targeted testing in areas with limited prior testing, older housing, rental concentration, and socioeconomic disadvantage. A mitigation assistance program should be established with income-based eligibility. Clinical partners should integrate radon questions into smoking cessation and lung cancer screening programs. All publicly supported testing programs should track test completion, result, referral, remediation, and confirmation testing.

During years 2 and 3, policy evaluation should assess coverage, equity, cost, implementation, and exposure reduction. Indicators should include testing rates, elevated findings, mitigation completion, post-mitigation concentrations, contractor availability, resident knowledge, and distribution of program benefits. A standardized evaluation approach would support accountability and comparison across reporting periods (Martell et al., 2023).

## **Strengths**

The review integrated epidemiological evidence, risk communication research, housing factors, legislation, technical guidance, and local public health activity. Current federal and Illinois sources were used to assess legal duties and program structure. The analysis also separated disclosure, testing, mitigation, enforcement, finance, and surveillance. This distinction supported a clearer assessment of where policy activity existed and where exposure reduction remained incomplete.

A further strength was the focus on housing equity. Homeowners, renters, landlords, builders, and residents with limited financial resources faced different barriers. The review therefore avoided treating all households as one group. The local focus also produced actions linked with Springfield agencies and current community outreach.

## **Limitations**

The narrative design did not follow a registered systematic review protocol. Source selection remained open to reviewer judgment and publication bias. The search focused on English-language evidence and selected databases. Some local policies or unpublished program records were not identified.

Springfield-specific exposure data were limited. State surveillance data were dated and did not provide a population denominator for all local homes. Voluntary testing also introduced selection bias. No valid estimate of local radon prevalence, mitigation completion, or radon-attributable lung cancer burden was produced.

Evidence from other states and countries informed analysis of communication, equity, and mitigation barriers. Differences in housing, law, health systems, and public resources limited direct transfer to Springfield. These studies supported policy interpretation rather than local effect estimates.

The policy environment changes over time. Statutes and agency guidance in this review were checked through July 27, 2026, but they should be rechecked on the journal-submission date. Final legal and programmatic claims should reflect the position in force at submission.

## **V. Policy Recommendations**

A coordinated radon-control program is recommended for Springfield and Sangamon County. The program should connect surveillance, communication, testing, mitigation, housing policy, clinical prevention, and evaluation. Responsibility should be shared across public health agencies, housing authorities, building officials, healthcare institutions, academic partners, licensed radon professionals, landlords, tenants, and community organizations.

### **Establish Local Radon Surveillance**

The Sangamon County Department of Public Health should establish a local radon surveillance system. Annual reporting should include the number of completed tests, the proportion of results below 2 pCi/L, the proportion between 2 and 4 pCi/L, and the proportion at or above 4 pCi/L. Reports should include mitigation completion and post-mitigation results.

Data should be reported by ZIP code or census tract after residential privacy has been protected. Separate summaries should be prepared for owner-occupied homes, rental properties, schools, child care facilities, and publicly supported housing. Reporting should distinguish test kit distribution from completed testing. This distinction would prevent overestimation of program reach.

A data sharing agreement should be developed between state agencies, local health authorities, licensed radon professionals, universities, and housing agencies. The agreement should define data fields, submission periods, privacy protections, and reporting responsibilities.

Recommended indicators include:

- Number of completed residential tests per 1,000 households.
- Percentage of tests at or above 4 pCi/L.
- Percentage of elevated homes with documented mitigation.
- Percentage of mitigated homes with confirmation testing.
- Testing rates by housing tenure, income, and geographic area.

These indicators would support routine assessment of exposure, service access, and equity. Standardized evaluation was identified as a core feature of effective radon action plans (Martell et al., 2023).

### **Expand Targeted Testing and Risk Communication**

Free or low-cost test kits should be distributed through libraries, health centers, schools, child care facilities, community organizations, housing offices, and clinical services. Priority should be given to neighborhoods with older housing, high rental occupancy, low household income, limited previous testing, or elevated geological potential.

Public communication should follow a complete action pathway. Each message should explain the health risk, testing process, interpretation of results, mitigation options, expected costs, licensed service contacts, and available financial support. Messages should state no known safe radon concentration exists. EPA action guidance for results at or above 4 pCi/L should be presented clearly. Exposure reduction between 2 and 4 pCi/L should receive attention (United States Environmental Protection Agency [EPA], 2025).

Communication materials should be written in plain language and translated into languages used by local residents. Separate materials should be prepared for homeowners, tenants, landlords, builders, schools, and healthcare professionals. Clinical messages should connect radon reduction with smoking cessation and lung cancer screening.

Program evaluation should measure knowledge, test completion, elevated findings, referrals, mitigation, and confirmation testing. Awareness alone should not serve as the primary success measure. Research showed knowledge did not consistently lead to testing or remediation when financial and housing barriers remained present (Cori et al., 2022, Hevey et al., 2023).

### **Establish Mitigation Financial Assistance**

A local mitigation assistance fund should be established for low-income homeowners and qualifying rental properties. Funding sources should include federal housing programs, state grants, local healthy housing funds, hospital community benefit programs, and philanthropic support.

Eligibility criteria should be transparent. Priority should be based on household income, radon concentration, presence of children, smoking exposure, housing condition, and inability to finance mitigation. Assistance should cover professional assessment, active soil depressurization, electrical work, system activation, and post-mitigation testing.

Payments should be issued directly to licensed mitigation professionals after completion and verification. Quality assurance should follow current EPA and ANSI AARST standards. Annual reports should state the number of applications, approvals, completed systems, average cost, final radon concentration, and geographic distribution of assistance.

Financial support was necessary because information without affordable remediation left exposure unchanged. Cost, service fragmentation, and limited institutional support were identified as major barriers to household action (Hevey et al., 2023).

### **Strengthen Rental Housing Protection**

Rental protection should move beyond disclosure while remaining consistent with Illinois law. Because 420 ILCS 46/35 limits home-rule regulation of lease agreements or tenant rights that would be inconsistent with the Illinois Radon Awareness Act, Springfield should first use legally available tools such as education, referral systems, incentives, data collection, and conditions attached to locally controlled housing funds, while advocating state-level amendments if broader mandatory testing or mitigation duties are sought (Illinois General Assembly, n.d.-b).

At the state level, a strengthened rental framework could require a defined response to confirmed results at or above 4 pCi/L, mitigation by licensed professionals within a specified period, and post-mitigation testing before case closure. Any local implementation should be reviewed for consistency with state preemption and existing tenant-rights provisions.

Tenant protections should also address retaliation, avoidable displacement, and inappropriate transfer of remediation costs. Where temporary relocation is necessary during work, assistance should be considered through legally available housing programs. Test records and mitigation documentation should be retained in a form that supports future disclosure while protecting resident privacy.

Lease termination alone should not be treated as the primary public health remedy. Departure by one household does not remove the environmental source; property-based correction offers stronger protection for current and future occupants.

### **Integrate Radon Into Housing and Building programs**

Radon testing should be included in housing rehabilitation, weatherization, energy efficiency, home repair, and healthy housing programs. Pre-work testing should identify existing exposure. Post-work testing should determine whether pressure or ventilation changes altered indoor concentration.

Building inspections should verify required radon-resistant features in new residential construction. Post-construction testing should be promoted before occupancy. Passive systems should be activated when indoor results meet or exceed the EPA action level.

Publicly supported housing projects should include radon assessment within environmental review, rehabilitation planning, and property management. HUD policy provided a federal basis for radon assessment within covered housing activities (United States Department of Housing and Urban Development, 2024).

### **Strengthen Healthcare Participation**

Healthcare institutions should include brief radon education within tobacco cessation, pulmonary care, primary care, and lung cancer screening programs. Patients with smoking histories should receive clear information on the combined risk from smoking and radon exposure.

Electronic health record prompts should direct eligible households toward local test kit programs and licensed mitigation services. Health systems should record the number of referrals and completed household tests where consent and privacy requirements were met.

Healthcare participation would extend risk communication beyond real estate transactions. Clinical settings offered repeated contact with populations at higher absolute lung cancer risk.

### **Establish Governance and Accountability**

A Springfield Radon Action Group should coordinate implementation. Membership should include public health agencies, housing authorities, building officials, tenant representatives, landlords, licensed radon professionals, healthcare systems, universities, schools, and community organizations.

The group should publish a three-year action plan. Each action should identify the responsible agency, target population, funding source, implementation date, process measure, outcome measure, and equity measure. Progress should be reported each year.

External review should be completed after three years. The review should assess testing coverage, mitigation completion, geographic equity, rental compliance, communication reach, program cost, and reduction in indoor radon concentrations.

## **VI. Conclusion**

Residential radon is an established and preventable cause of lung cancer and is relevant to Springfield and Sangamon County because elevated indoor radon has been documented across Illinois. However, the reviewed sources did not support a precise Springfield-specific estimate of household prevalence, mitigation completion, or radon-attributable lung-cancer burden. The local public health response should therefore combine risk reduction with stronger surveillance rather than infer local burden from statewide or selected testing data.

Illinois has established measures for radon disclosure, professional licensing, child-care testing, and radon-resistant construction. Important gaps remain for existing homes, rental protection, mitigation financing, current local data, and post-mitigation verification. These gaps can place greater burdens on renters, low-income homeowners, and residents with limited control over housing conditions.

Springfield and Sangamon County should pursue a coordinated radon-control strategy led by public health, housing, building, healthcare, and community partners. Priority actions include current local surveillance, targeted test-kit distribution, mitigation assistance, legally feasible rental protections, clinical education, and annual program evaluation. Each action should identify a responsible agency, implementation period, funding source, and measurable outcome.

A policy approach centered on verified exposure reduction would strengthen lung-cancer prevention and environmental health equity. Progress should be measured through completed testing, mitigation uptake, post-mitigation concentrations, and equitable access across population groups.

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