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Reviewing the Research: Making the Case for Mineral Fiber Insulation

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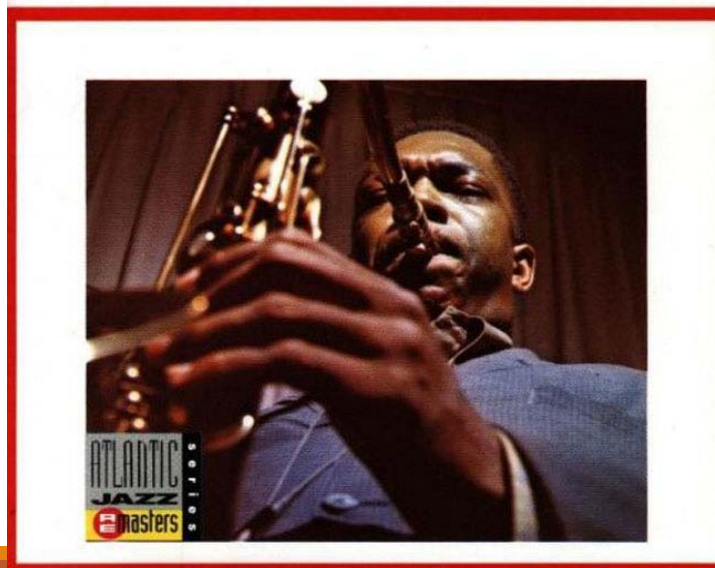
**General Counsel and Executive Vice President
North American Insulation Manufacturers Association**

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Who Is NAIMA?

NAIMA IS THE TRADE ASSOCIATION FOR NORTH AMERICAN MANUFACTURERS OF FIBER GLASS, ROCK WOOL, AND SLAG WOOL INSULATION PRODUCTS. NAIMA PROMOTES ENERGY EFFICIENCY AND ENVIRONMENTAL PRESERVATION THROUGH THE USE OF INSULATION AND SPONSORS PRODUCT STEWARDSHIP EFFORTS.

JOHN COLTRANE GIANT STEPS



What Is Fiber Glass and Rock and Slag Wool Insulation?

- FIBER GLASS – SAND, GLASS CULLET (RECYCLED GLASS), MINERALS SUCH AS LIMESTONE, AND SODA ASH MELTED AND FIBERIZED INTO VARIOUS INSULATION PRODUCTS
- ROCK AND SLAG WOOL – ROCK (BASALT), BLAST FURNACE SLAG, AND MINERALS MELTED AND FIBERIZED INTO INSULATION



Typical Glass, Rock & Slag Insulation Wool Products



Batts

Duct Board

Pipe

Loosefill

**Original Equipment
Manufacturer**

Acoustic & Ceiling Tile





Respiratory protection is not recommended for batt installation because exposures are well below 1 f/cc





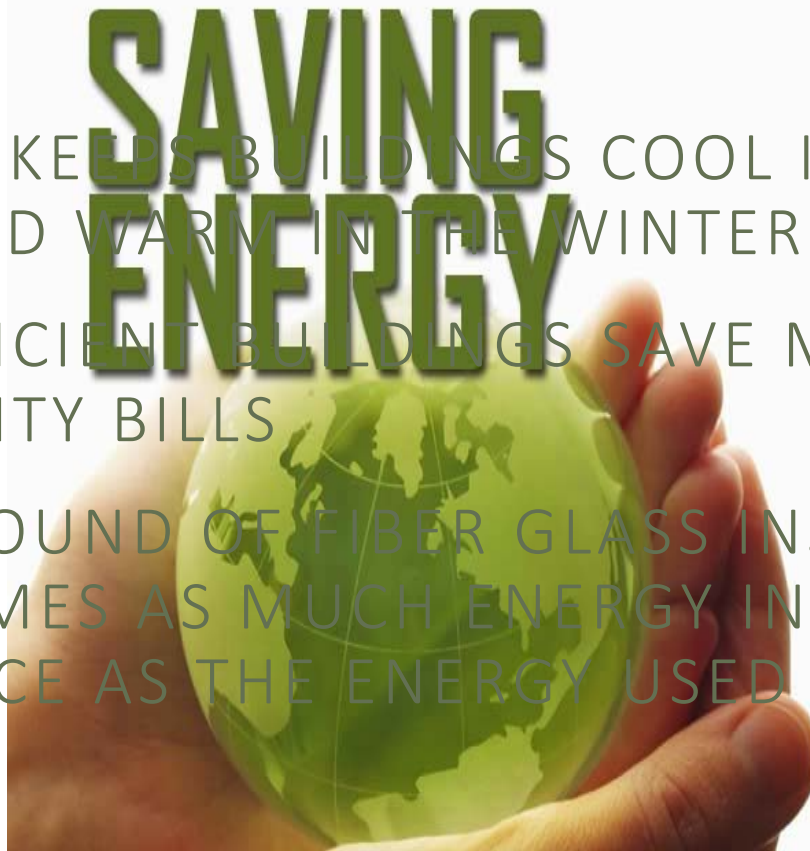
Respiratory protection is not recommended for batt installation because exposures are well below 1 f/cc



Respiratory protection is not recommended for board installation because exposures are well below 1 f/cc

Benefits of Insulation

- INSULATION MAKES BUILDINGS MORE ENERGY EFFICIENT
- INSULATION KEEPS BUILDINGS COOL IN THE SUMMER AND WARM IN THE WINTER
- ENERGY-EFFICIENT BUILDINGS SAVE MONEY AND LOWER UTILITY BILLS
- A TYPICAL POUND OF FIBER GLASS INSULATION SAVES 12 TIMES AS MUCH ENERGY IN ITS FIRST YEAR IN PLACE AS THE ENERGY USED TO PRODUCE IT





Benefits of Insulation

- THE 1943 *MODERN MEDICAL COUNSELOR* IN ITS ADVICE FOR IMPROVED HEALTH SUGGESTED THE FOLLOWING:
 - *“If modern insulating materials are used in the building of a new home, it will be better protected against the extremes of heat and cold and will conserve fuel.”*
 - This is particularly important in protecting babies and older people
- *THE BRITISH JOURNAL OF BRITISH MEDICINE* (1964) – “COLD THE KILLER” – ADVOCATED THE USE OF INSULATION TO CORRECT THE HYPOTHERMIA PROBLEM AMONG THE ELDERLY AND INFANTS
 - “The old people should be given help with insulation of their houses. . . by official or voluntary services”

NAIMA Represents an Industry That:

- FULLY AND PROPERLY
 - Evaluates the hazards of our members' products
 - Communicates those hazards
- BUT ALSO EVALUATES THE PUBLIC HEALTH BENEFITS OF OUR PRODUCTS
- EVALUATES EXPOSURE TO FIBER (NAIMA'S DATABASE CONTAINS OVER 18,000 DATA POINTS)
- ADOPTED A VOLUNTARY AND PROACTIVE APPROACH TO POLLUTION PREVENTION
- ADOPTED, WITHOUT ANY REGULATORY REQUIREMENT, A COMPREHENSIVE PRODUCT STEWARDSHIP PROGRAM – THE HEALTH AND SAFETY PARTNERSHIP PROGRAM (“HSPP”) – WITH OSHA, WHICH WAS TRANSFORMED INTO NAIMA'S PRODUCT STEWARDSHIP PROGRAM

Health and Safety Partnership Program (HSPP)



- OSHA'S PRIORITY PLANNING PROCESS
 - Listed synthetic vitreous fibers plus 17 other materials
- NAIMA OPTED FOR VOLUNTARY STANDARD
- JOINT EFFORT BETWEEN OSHA, NAIMA, UNIONS, AND OTHER TRADE GROUPS CREATED THE HSPP
- KEY COMPONENTS OF HSPP
 - Recommended PEL
 - Comprehensive work practices
 - Training programs and material
 - Specific guidance for respiratory protection
 - Most important element – exposure database
- ARIZONA STATE UNIVERSITY OVERSEES AND MANAGES EXPOSURE DATABASE
- DATABASE INCLUDES BOTH PERSONAL AND AREA SAMPLES AND IDENTIFIES EVERY CONCEIVABLE JOB TASK WITH AVERAGE EXPOSURES

Health and Safety Partnership Program



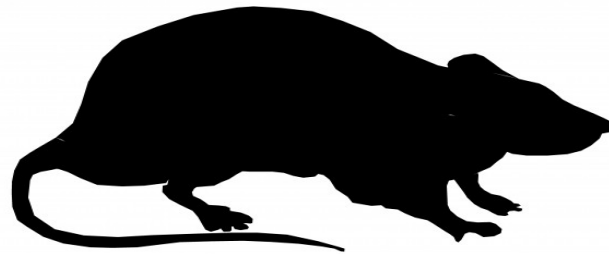
- OSHA HAS AUTHORIZED INSULATION CONTRACTORS TO RELY ON THE DATABASE
 - The database includes manufacturing, fabricator, and installer exposure data
- THE EXPOSURE DATABASE IS A LIVING DATABASE, WHICH MEANS NEW DATA IS COLLECTED AND ADDED ON AN ANNUAL BASIS
- IARC, NTP, AND CALIFORNIA RELIED UPON THIS DATABASE IN MAKING THEIR DELISTING DECISION
 - OSHA references the database on its website
- THREE PEER-REVIEWED ARTICLES HAVE BEEN PUBLISHED ON THE DATABASE
- AFTER 8-YEAR PROGRAM WITH OSHA, HSPP WAS CONVERTED TO NAIMA PRODUCT STEWARDSHIP PROGRAM

A History of Product Stewardship and Medical and Scientific Research

- 1930 – RESEARCH ON SYNTHETIC VITREOUS FIBERS OR MAN-MADE VITREOUS FIBERS COMMENCES
- 1942 – DR. W. J. SIEBERT PUBLISHES FIRST EPIDEMIOLOGY STUDIES ON MANUFACTURING WORKERS
- 1950S-1960S – ONGOING RESEARCH
 - Animal
 - Epidemiology
- 1970S–1980S – ANIMAL IMPLANTATION STUDIES BECOME PREVALENT
 - Implantation studies – fibers were surgically implanted or injected into the animals lungs
 - These tests sometimes resulted in tumors in the laboratory animals

Consequences of Animal Testing In Animal Implantation Studies

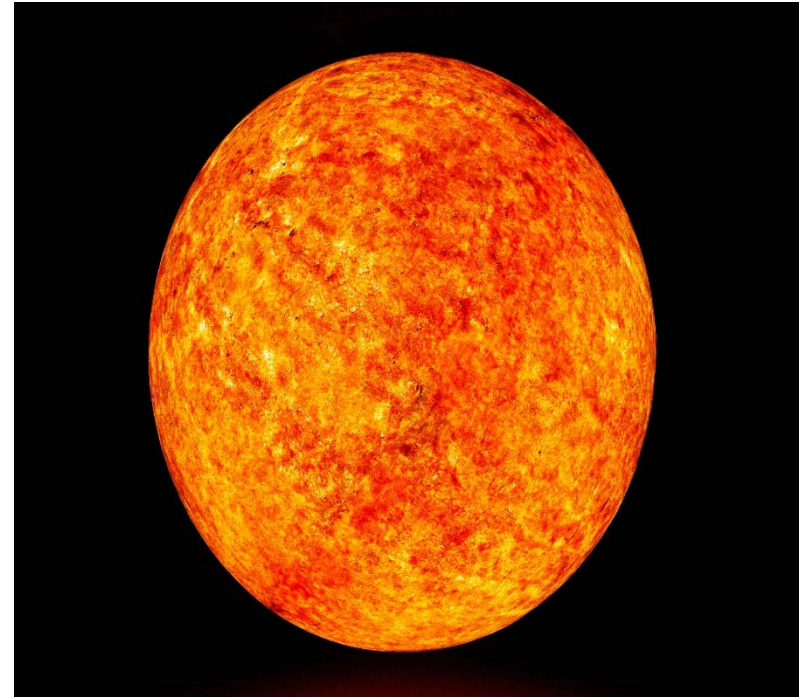
- PRESENCE OF TUMORS TRIGGERED REVIEW BY THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (“IARC”)
- IN 1988, IARC, BASED ON ANIMAL IMPLANTATION STUDIES, LISTED FIBER GLASS AND ROCK AND SLAG WOOL INSULATION PRODUCTS AS A POSSIBLE CARCINOGEN
 - Rats were exposed to very large amounts of fibrous glass via implantation and injection
 - Epidemiological studies did not support a finding of carcinogenicity



IARC Classifications

- IARC MENU OF CLASSIFICATION

- Known – Group 1 (Total 114)
 - Tobacco
 - Asbestos
 - All alcoholic beverages
 - The sun
- Probable – Group 2A (Total 69)
 - Lead
 - PCBs
- Possible – Group 2B (Total 283)
 - Barbequed meats
- Not Classifiable – Group 3 (Total 50)
 - Caffeine
 - Fiber glass and mineral wool
 - Cholesterol
 - Electric fields
- Not a Carcinogen
 - None



Consequences of Animal Testing In Animal Implantation Studies

- AS A RESULT OF IARC'S DECISION, CALIFORNIA'S OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT ("OEHHA"), ADMINISTRATORS OF PROPOSITION 65, ADDED FIBER GLASS TO ITS LIST OF CARCINOGENS
- THE NATIONAL TOXICOLOGY PROGRAM ("NTP") FOLLOWED SUIT AND ADDED FIBER GLASS TO ITS REPORT ON CARCINOGENS ("ROC")
- OSHA'S HAZARD COMMUNICATION STANDARD MANDATES THAT A LISTING BY ANY ONE OF THESE AGENCIES REQUIRES THAT THE SUBSTANCES OR PRODUCT BE LABELED AS A CARCINOGEN
- NOW FOR THE FIRST TIME, FIBER GLASS AND ROCK AND SLAG WOOL PRODUCTS CARRY CANCER WARNING LABELS

Some of the Impacts of a Cancer Warning Label

- CONSUMER FEAR
- MARKET IMPACT
- BIAS AND PREJUDICE FROM PRODUCT SPECIFIERS
 - Green movement
 - Environmental groups
 - Health advocacy groups
 - Untested substitutes are recommended
- COMPETITORS, WHO HAVE NEVER TESTED THEIR PRODUCTS, USE IT AGAINST FIBER GLASS AND ROCK AND SLAG WOOL INSULATION PRODUCTS IN THEIR ADVERTISING
- FIBER GLASS BECAME KNOWN AS THE PRODUCT WITH THE CANCER WARNING LABEL



A Problem with Animal Implantation Studies

- ANIMAL IMPLANTATION STUDIES WERE NOT USING
A RELEVANT ROUTE OF HUMAN EXPOSURE

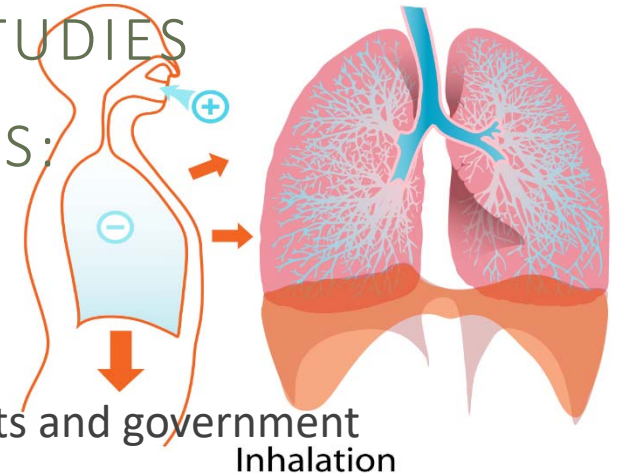


RELEVANT



Animal Inhalation Studies

- THERE WERE SEVEN INHALATION STUDIES
- RCC WAS SELECTED BECAUSE IT WAS:
 - State of the art
 - Advances in study design
 - Advances in technology
 - Recommended and accepted by third-party experts and government officials
- MOTIVES FOR TESTING:
 - Delisting and changing the public record
 - Product stewardship
 - Removal of stigma
 - Liability defense
 - Response to customers
 - Supporting documentation for industry position



A Decision To Test

- THE FACTS SUPPORTED TESTING
 - Epidemiological evidence did not support a finding of carcinogenicity
 - Animal implantation studies were not using a relevant route of human exposure
 - IARC relied upon implantation studies because there were no “well designed animal inhalation studies”
 - Nobody was implanting fiber glass
 - Governmental and scientific groups (NIOSH 1977; EPA 1988; IPCS 1988; CPSC 1991; WHO 1992) were concluding that the most meaningful animal studies for assessing potential human hazard or risk from fibers are inhalation studies
 - “[e]xposure conditions in inhalation studies approach most closely the circumstances of human exposure and are more relevant for characterization of risks to man.”^{FN}

^{FN} International Programme on Chemical Safety, WHO, Environmental Health Criteria 77, *Man-Made Mineral Fibres* (1988)

A Decision To Test

- MAKING CERTAIN THAT THE TEST RESULTS WERE ACCEPTED
 - Experts (including IARC) were consulted and helped select:
 - The lab
 - Type of inhalation studies
 - Animals to be tested
 - Number of tests
 - EPA and OSHA were regularly apprised of test results
 - Industry had sign-off on all aspects of the testing
 - A bold decision
 - Reversal of previous listings is rare and difficult
 - Time consuming and expensive
 - Reversal is an admission that IARC was wrong the first time
 - Some argued that there was no harm to leave it on the list – a precaution
 - A no reversal policy actually serves as a disincentive to test



The Result

- IARC DELISTED FIBER GLASS AND ROCK AND SLAG WOOL INSULATION
 - In October 2001, IARC delisted fiber glass and rock and slag wools that are used for thermal and acoustical insulation; these fibers are now considered not classifiable as to carcinogenicity
 - A significant and rare accomplishment
 - “Epidemiologic studies published during the 15 years since the previous IARC Monographs review of these fibres in 1988 provide no evidence of increased risks of lung cancer or mesothelioma (cancer of the lining of the body cavities) from occupational exposures during manufacture of these materials, and inadequate evidence overall of any cancer risk.”
- THE ANIMAL INHALATION STUDIES SUCCESSFULLY DEMONSTRATED THAT ANIMAL DATA WAS LIMITED – OFFSET THE IMPLANTATION STUDIES
- TWO SIGNIFICANT INNOVATIONS THAT CAME OUT OF THE RCC STUDIES PER IARC’S SUGGESTION
 - Ability to produce large quantities of size-selected respirable fibers
 - Nose-only exposure vs. previous inhalation studies that were whole body

Biosolubility

- BIOSOLUBILITY WAS ANOTHER FACTOR IN THE IARC DECISION
- IARC FOUND THAT BIOPERSTENCE TESTS PROVIDE A CLEAR DELINEATION BETWEEN BIOSOLUBLE (NOT CLASSIFIABLE AS CARCINOGENS) AND BIOPERSTENT (CLASSIFIABLE AS CARCINOGENS) FIBERS
- BIOSOLUBILITY STUDIES SUPPORT THE CONCLUSION THAT FIBER GLASS INSULATION IS NOT CLASSIFIABLE AS A CARCINOGEN
- BIOSOLUBLE GLASS WOOL FIBERS DISSOLVE MORE RAPIDLY IN BODY FLUIDS THAN OTHER FIBERS THAT HAVE BEEN ASSOCIATED WITH HUMAN DISEASE

Two More Listings

- NTP
 - The NTP in June 2011 removed from its Report on Carcinogens all biosoluble glass wool used in home and building insulation and for non-insulation products
 - 10-year process
- PROPOSITION 65
 - In November 2011, California's OEHHA published a modification to its Proposition 65 listing to include only "Glass wool fibers (inhalable and biopersistent)"
 - 2-month process (incredibly succinct)



Significant Binder Change

- THE FIBER GLASS INDUSTRY VOLUNTARILY SUBSTITUTED FORMALDEHYDE BINDERS WITH NON-PHENOLIC BINDERS THAT ARE STARCH OR SUGAR BASED
- THE WOOL FIBERGLASS MANUFACTURING MACT STANDARD REGULATED FORMALDEHYDE EMISSIONS
- FORMALDEHYDE WAS THE ONLY HAZARDOUS AIR POLLUTANT (“HAP”) EMITTED BY THE FIBER GLASS INSULATION MANUFACTURERS
- ADDITIONAL BINDER CHANGES ARE BEING EXPLORED FOR COMMERCIAL AND INDUSTRIAL PRODUCTS – BOTH FIBER GLASS AND MINERAL WOOL
- THIS VOLUNTARY REMOVAL OF FORMALDEHYDE RESULTED IN A REDUCTION OF A HAP GREATER THAN COULD EVER HAVE BEEN ACHIEVED BY EPA THROUGH REGULATIONS
- EPA DEEMED THESE ENVIRONMENTALLY PROACTIVE ACTIONS THAT SUBSTANTIALLY REDUCED HAPS FROM FIBER GLASS FACILITIES



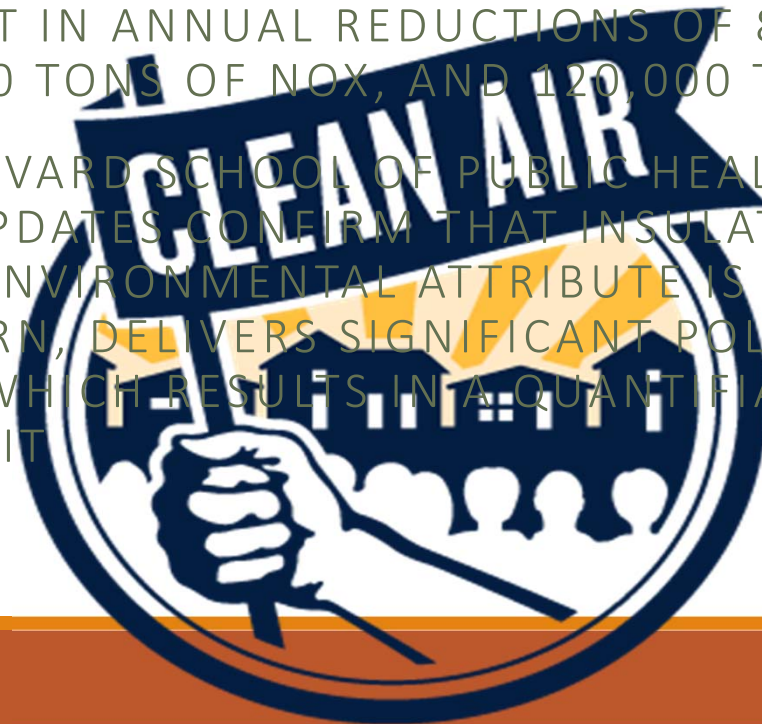
Significant Binder Change

- “SINCE PROMULGATION, WE ESTIMATE THAT INDUSTRY-WIDE METAL HAP EMISSIONS FROM PROCESS SOURCES HAVE BEEN REDUCED BY APPROXIMATELY 76 PERCENT. DUE TO INDUSTRY’S EFFORTS TO REPLACE PHENOL FORMALDEHYDE BINDERS, MORE THAN 95 PERCENT OF FORMALDEHYDE, PHENOL, AND METHANOL EMISSIONS HAVE BEEN REDUCED (OR WILL BE BY 2012). AS A RESULT, ACTUAL PM (METAL HAP), FORMALDEHYDE, PHENOL, AND METHANOL EMISSIONS FROM PROCESS SOURCES AT ALL WOOL FIBERGLASS MANUFACTURING FACILITIES ARE SIGNIFICANTLY LOWER THAN ARE ALLOWED UNDER THE 1999 MACT RULE.”



Energy Savings and Pollution Reduction

- INSULATION IS THE MOST COST-EFFECTIVE MEANS OF IMPROVING ENERGY EFFICIENCY IN BUILDINGS AND REDUCING GREENHOUSE GAS EMISSIONS
- STUDIES CONDUCTED BY THE HARVARD SCHOOL OF PUBLIC HEALTH IN 2002 AND 2003 AND UPDATED BY BOSTON UNIVERSITY IN 2016 CONFIRMED THAT ENERGY SAVINGS TRANSLATE INTO ANNUAL REDUCTIONS OF POLLUTANTS
- SPECIFICALLY, REDUCTIONS IN ELECTRICITY CONSUMPTION WOULD RESULT IN ANNUAL REDUCTIONS OF 80 MILLION TONS OF CO₂, 68,000 TONS OF NO_x, AND 120,000 TONS OF SO₂
- BOTH THE HARVARD SCHOOL OF PUBLIC HEALTH AND BOSTON UNIVERSITY UPDATES CONFIRM THAT INSULATION'S MOST SIGNIFICANT ENVIRONMENTAL ATTRIBUTE IS SAVING ENERGY WHICH, IN TURN, DELIVERS SIGNIFICANT POLLUTION REDUCTIONS WHICH RESULTS IN A QUANTIFIABLE PUBLIC HEALTH BENEFIT



Embodied Carbon Reduction

- COMPANIES ARE LOOKING AT CARBON REDUCTION IN THE PRODUCTION OF ITS INSULATION PRODUCTS
- SOME INSULATION PRODUCTS HAVE BEEN CERTIFIED AS MADE WITH 100% WIND-POWERED ELECTRICITY
- THE DYNAMICS OF THE INDUSTRY WOULD SUGGEST THAT THIS MOVEMENT WILL HAVE A RIPPLE EFFECT



Recycled Content

- RECYCLED CONTENT FOR FIBER GLASS IS 40-60 PERCENT – INCREASED FROM PREVIOUS YEARS
- RECYCLED CONTENT FOR SLAG WOOL IS 70-90 PERCENT
- SINCE 1992, NAIMA HAS CONDUCTED AN ANNUAL SURVEY TO DETERMINE THE VOLUME OF RECYCLED MATERIALS USED
- THE MOST RECENT SURVEY SHOWED THAT IN 2017, NAIMA MEMBER COMPANIES IN THE UNITED STATES AND CANADA USED MORE THAN 2.5 BILLION POUNDS OF RECYCLED GLASS
- SINCE 1992, WHEN NAIMA STARTED COLLECTING RECYCLING DATA, 58.2 BILLION POUNDS OF RECYCLED MATERIAL HAVE BEEN DIVERTED FROM THE WASTE STREAM



Recycled Content

- BY USING GLASS CULLET, RAW MATERIALS (SAND, SODA ASH, ETC.) USE WILL BE REDUCED
- THE LIFE OF THE FURNACES WILL INCREASE UP TO 30% - DECREASED MELTING TEMPERATURES AND LESS CORROSIVE BATCH
- REPORTS HAVE SHOWN THAT COMPARED TO 100% RAW MATERIALS, USING 30% GLASS CULLET REDUCES SILICA USE BY 60%, SODA ASH BY 40%, AND SAVES 10% IN ENERGY COSTS
- THERE IS A MOVEMENT TO REMOVE GLASS FROM THE WASTE STREAM
- NAIMA IS AN ACTIVE PROPONENT FOR RECYCLING GLASS

